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NASA-CR 167,384

GAP FILLER REUSE TESTS OF FULL-SCALE
SPACE SHUTTLE ORBITER TILE ARRAY MODELS
IN THE NASA/ARC 9x7-FOOT AND 11-FOOT
UNITARY PLAN WIND TUNNELS
(OS60, OS61A, OS61B, OS62, OS62A AND OS63)

SPACE SHUTTLE AEROTHERMODYNAMIC DATA REPORT

Data Management SERVICES

HUNTSVILLE ELECTRONICS DIVISION



CHRYSLER
CORPORATION

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by

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Space Transportation & Systems Group

Prepared under NASA Contract Number NAS9-16283

by

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for

Systems Engineering Division
Johnson Space Center
National Aeronautics and Space Administration
Houston, Texas

WIND TUNNEL TEST SPECIFICS:

Test Number:	500-1-11	507-1-11	507-1-97	531-1-11	531-1-11	531-1-97
NASA Series Number:	OS60	OS61A	OS61B	OS62	OS62A	OS63
Tunnel:	11x11	11x11	9x7	11x11	11x11	9x7
Fixture Number:	96-Ø	96-Ø	81-Ø	96-Ø	96-Ø	81-Ø
Panel Number:	RT-3	RT-4 No.1	RT-4 No.2 3,4, RT-2 No.3	RT-2 No.1	RT-2 No.1	RT-2 No.2,3,4
Occupancy Hours:	8	16	32	32	24	36
Test Dates:						
Start	6-9-81	9-18-81	8-13-81	2-9-82	3-3-82	2-23-82
End	6-9-81	9-18-81	8-14-81	2-9-82-	3-3-82	2-24-82

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ABSTRACT

This report documents a series of Space Shuttle Orbiter Thermal Protection System gap filler tests which was successfully completed during the period from June 1981 to March 1982. These tests were designed to determine if the gap fillers could be reused for STS-2, -3 and -4. A total of nine TPS tile gap filler reuse panels were tested. These panels were mounted in the 81-Ø and 96-Ø test fixtures. The fixtures were installed in the 9x7- and 11x11-foot unitary plan wind tunnels, at the NASA/Ames Research Center.

The tests were conducted at free stream Mach numbers from .76 to 1.8 and dynamic pressures from 468 to 1030 psf. The primary objective of the tests was to demonstrate that the gap fillers remained attached to the structure under simulated flight environments. All test articles met the primary test objective.

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INTRODUCTION

The reason for the subject tests was to determine if the gap fillers between TPS tiles on the Space Shuttle Orbiter Vehicle could be reused for STS-2, -3 and -4. Tests OS60, OS61A and OS61B were designed to determine if the gap fillers could be reused for STS-2. Tests OS62, OS62A and OS63 were designed to determine if the Ames gap filler could be reused for STS-3 and -4.

The objective of the tests was accomplished by exposing the gap filler panels to appropriate aerodynamic loading environments. The test sequence was: Plasma ARC, Vibro-Acoustic, Wind Tunnel, and then Plasma ARC simulating the STS-2, -3, and -4 flight conditions. The tests were performed at free stream Mach numbers from .76 to 1.8 and dynamic pressures from 468 to 1030 psf.

This report presents information on the conduct of the tests, details of the fixtures, test facility and instrumentation, and plotted and tabulated data.

NOMENCLATURE

<u>SYMBOL</u>	<u>MNEMONIC</u>	<u>DEFINITION</u>
ART		Article
Cp	CP	Local pressure coefficient
C _p _{RMS}		Pressure coefficient of the local fluctuating pressure
dB		Volume of sound (decibel)
Deg		Degrees
GAIN		Heff amplifier gain, volts/volt
G/F		Gap Filler
HRSI		High-Temperature Reusable Surface Insulation
K3		System Pressure, counts/psi
L.E.		Leading Edge
M Mach Mach No.	MACH	Mach number
NOVA Counts		Count output by NOVA computer
OFT		Orbiter Flight Test
P	P	Freestream static pressure
P'		Local fluctuating pressure, psi
PCF		Pounds per cubic foot
Pi		Local static pressure, psia
P _T	PT	Freestream total pressure, inches of Hg
q	Q	Dynamic pressure, psf
RMS		Root-Mean-Square
RT		Reuse Test

NOMENCLATURE (Concluded)

<u>SYMBOL</u>	<u>MNEMONIC</u>	<u>DEFINITION</u>
S_F		Trailing edge flap angle, degrees
SIP		Strain isolation pad
T.E.		Trailing edge
TTF	TTF	Total temperature, degrees Fahrenheit
X	X	Longitudinal distance - positive aft of panel leading edge, inches
Y	Y	Lateral distance - positive to the right of panel centerline, inches
θ_f	FLAP	Flap angle, degrees
δ_f		
δ_{FLAP}		

REMARKS

Test OS62 was run at a dynamic pressure of 470 psf instead of the requested 750 psf. Although the pressure coefficients were correct, the actual shock pressures applied to the test article were one third lower than requested. This was not a satisfactory loading for STS-3 and STS-4. Test OS62A is a rerun of test OS62 and was run at the originally requested dynamic pressure of 750 psf.

CONFIGURATIONS INVESTIGATED

Fixtures 81-Ø and 96-Ø were used in performing the six gap filler tests reported in this document. Fixture 81-Ø was used for tests OS61B and OS63 in the 9x7-foot wind tunnel. Fixture 96-Ø was used for tests OS60, OS61A, OS62, and OS62A in the 11x11-foot wind tunnel. Figure 1 i) and j) show sketches of fixtures 96-Ø and 81-Ø respectively.

Fixture 81-Ø produced a compression shock on the test article and was designed to be installed in the ARC 9x7-ft. UPWT. The specimen holding panel was mounted in the ceiling of the tunnel. Separated flow conditions on the test articles were produced by deflecting the 12-inch chord flap with a 100-inch span, located aft of the panel. The flap, hinged on the ceiling, can be rotated from zero to 90 degrees by a remotely controlled hydraulic actuator.

Fixture 96-Ø produced a recompression shock on the test article and was designed to be installed in the ARC 11x11-ft. UPWT. Its basic components were a leading edge flap, side plates, and pressure box. The mechanism employed to produce the desired expansion/recompression shocks was a full-span, 15-inch chord flap located at the leading edge of the fixture. The flap can be rotated through angles from zero to 30 degrees by a remotely controlled hydraulic actuator. The center of rotation of the flap was fixed at a point 2.75 inches below the top surface of the test panel, at its leading edge ($X = \text{zero}$).

CONFIGURATIONS INVESTIGATED (Continued)

The side plates (98x56 inches) extended from a height of three feet above the top of the test panel all the way to the floor and were supported from the sides. The beveled leading edges were located 26 inches forward of the test specimen leading edge. The sealed pressure box enclosed the area under the panel.

Nine different test articles were used for the gap filler tests discussed in this report: OS60 tested RT-3; OS61A tested RT-4 No.1; OS61B tested RT-2 No. 3 and RT-4 Nos. 2,3 and 4; OS62 and OS62A tested RT-2 No. 1; and OS63 tested RT-2 Nos. 2,3 and 4.

Test article RT-3 had a 7.9-inch by 19.9-inch array of 3.0-inch to 3.06-inch thick HRSI tiles mounted on a 3/8-inch thick flat plate which was, in turn, mounted on a 27.5-inch by 43-inch by 3/8-inch thick plate. The tiles were instrumented with 92 thermocouples which were not used during these tests. The 14 pressure orifices in the panel side frames provided data to define the tile environment during the tests.

Foam tiles were designed and installed around test article RT-3. All foam tiles were bonded to 0.16-inch SIP in order to properly simulate the bleed path encountered in the flight article.

Each of the remaining test articles consisted of a base plate, HRSI tile array with gap filler, and close-out area section. The base plates were 27.5 inches wide by 43 inches long. The exposed area of each article was 24.15 inches by 40.24 inches.

CONFIGURATIONS INVESTIGATED (Concluded)

The HRSI tile array was 18 inches square. This array was mounted at the leading edge of the exposed area in the center of the panel. The tiles used in tests OS61A and OS61B were 2.5 inches thick. The tiles used in tests OS62, OS62A and OS63 were 2.04 inches thick.

The close-out area section immediately behind the HRSI tiled area was filled with dummy tiles mounted on SIP.

Shims and spacers were available for each specimen test panel to bring the leading edge of the test articles flush with the surface of the fixtures. The shims were fitted with O-ring type seals or a sealant to prevent leakage to and from the cavities behind the backing plates.

INSTRUMENTATION

Data recorded during the tests consisted of static and dynamic pressures. Each test recorded static pressure data while only OS60 and OS61B involved dynamic pressure measurements. These static and dynamic pressures were obtained using multi-port Scanivalves and Kulite dynamic pressure transducers, respectively.

Each model fixture, 96- ϕ and 81- ϕ , was instrumented with peripheral static and dynamic pressure orifices. The number of orifices used varied from test to test. The locations of the static pressure taps and Kulite transducers, employed for the various tests, are tabulated in Table II and illustrated in Figure 1. Data from these transducers indicated the test environments which the panels were experiencing.

Rockwell supplied the Scanivalves, transducers, and associated cabling used during the tests. The Scanivalves incorporated Statham ± 10 psi transducers and were used to record the panel edge static pressures.

The dynamic signals from the Kulite transducers were used to visually locate the shock position on an oscilloscope. The signal from these transducers was not recorded.

Each model fixture, incorporated a flap drive system which included a position transducer to measure the angular deflections of the flap. ARC accepted the signals from the transducers and provided visual readouts to permit continuous monitoring of the flap deflections.

TEST FACILITY DESCRIPTION

The NASA Ames 11-Foot Transonic Wind Tunnel is the transonic leg of the Ames Unitary facility. It is a closed circuit, single return, continuous flow, variable-density tunnel. The 11x11x22-foot long test section is slotted to permit transonic testing. The nozzle has adjustable sidewalls. The tunnel air is driven by a 3-stage axial flow compressor powered by four wound-rotor induction motors. The speed of the motors is varied as necessary to provide the desired Mach number. The motors have a combined output of 180,000 horsepower for continuous operation or 216,000 horsepower for one hour. Tunnel temperature is controlled by aftercoolers and a cooling tower. Four 30,000 cubic-foot storage tanks provide dry air for tunnel pressurization.

The tunnel can be operated at nominal Mach numbers of .5 to 1.4, Reynold's number per foot $\times 10^{-6}$ of 1.7 to 9.4, dynamic pressure (PSF) of 150 to 2,000 and a total temperature ($^{\circ}\text{R}$) of 540 to 610, respectively.

This tunnel is used for force and moment, pressure, internal air flow-inlet, and dynamic stability tests.

TEST FACILITY DESCRIPTION (Concluded)

This tunnel is one of the supersonic legs of the Ames Unitary facility. It is a closed circuit, variable density, continuous flow tunnel. The test section is 9 feet by 7 feet by 18 feet and the nozzle is of the asymmetric, sliding-block type in which the variation of the test section Mach number is achieved by translating, in the streamwise direction, the fixed contour block that forms the floor of the nozzle. The temperature in all three circuits is controlled by after-cooling. Dry air for use in the circuit is supplied from four 30,000 cubic-foot spherical tanks. The tunnel drive motors and compressor also serve the 8 by 7-foot tunnel. The motors have a combined output of 180,000 horsepower for continuous operations or 216,000 horsepower for one hour.

TEST PROCEDURE

The test fixtures were the first items to be installed in the tunnels. The 96-Ø test fixture was mounted in the 11-foot tunnel on legs which extended through floor cutouts to beams located below the floor line. The beams actually supporting the model were attached to 8-inch I-beams spanning the tunnel. The floor cutouts below the model were filled in to provide smooth flow in the area. The lines to the flap drive were hooked up to the facility's hydraulic system.

The 81-Ø test fixture was installed in the roof hatch of the 9x7-foot tunnel. The compression shock component (flap) was installed at the trailing edge of the specimen-holding panel and the hydraulic drive was connected to the facility's system.

After the fixtures were installed in the tunnels, the test panels were fastened in place. Pillow and mini-gap fillers were installed in the tile gaps for OS60, OS61A and OS61B. These gap fillers were subjected to an STS-2 environment. Ames gap fillers and mini-pad gap fillers were installed in the tile gaps for OS62, OS62A and OS63. These gap fillers were subjected to STS-3 and -4 environments.

Tests OS60, OS61A, OS62 and OS62A were conducted in the 11-ft. wind tunnel. The tunnel was started at low P_T , then the flap was set at the appropriate position and the dynamic pressure was brought up to the desired value. Table I shows the run schedules for these tests.

TEST PROCEDURE (Continued)

Tests OS61B and OS63 were conducted in the 9x7-ft. wind tunnel. After the 9x7-ft. wind tunnel was started, the Mach number was set at the appropriate value and the dynamic pressure at the desired level. Then the shock was positioned by changing the flap angle. Table I shows the run schedules for these tests.

Table III shows the test chronology for OS60, OS62, OS62A and OS63.

The test chronology for OS61A and OS61A and OS61B was not documented but OS61A was similar to OS62 and OS61B was similar to OS63. For each test, video tape of the tiled panels was recorded to determine the time at which a tile segment separated from its respective SIP or a gap filler came loose.

Before and after each run on tests OS62A and OS63, static charge readings were taken on the panels used for these tests. An Anderson static meter was used to obtain these readings. Figure 3 shows the results of these readings.

Prior to the first test runs and at test conclusion, the TPS arrays of OS60, OS61A, OS61B, OS62, OS62A and OS63 required a complete alcohol wipe inspection of all coated surfaces of each tile with an individual tile scale crackmap record.

In addition, before each test run, tile step and gap measurements were performed. Results of these checks are shown in Figure 2.

OS-60 TUNNEL OPERATING PROCEDURE

1. Tunnel was evacuated until the total pressure was 7 psi.
2. The drive motors were started and the flow established at $M = 0.76$
3. The fixture flap was deflected from zero to 18 deg.
4. The tunnel total pressure was increased from 7 to 16.8 psi. This is the first test condition.
5. The Mach number was increased from 0.76 to 0.86 keeping the tunnel total pressure constant. Data were taken while conditions were changing.
6. The tunnel conditions were held constant at $M = 0.86$, $P_T = 16.8$ and a data point taken. (A total of eight points were taken during the run.)
7. Tunnel was brought off-line.

The above procedure was accomplished in the minimum lapsed time.

8. Panel was removed from tunnel and L&T completed the post-run inspections while the fixture (96-0) was being dismantled and removed from the tunnel.

0861A Tunnel Operating Procedure

1. The flap was set at 18 deg.
2. The tunnel was evacuated until the total pressure was 15 inches of Hg.
3. The drive motors were started and the flow established at $M = .84$.
4. The tunnel total pressure was increased from 15 inches of Hg to 21.5 inches of Hg.
5. Data were taken at $M = .84$, $q = 750$ psf, and $\phi_F = 18$ deg.
6. ϕ_F was increased from 18 to 24 deg.
7. Data were taken at $M = .84$, $q = 750$ psf, and $\phi_F = 24$ deg.
8. ϕ_F was decreased from 24 deg to 18 deg.
9. Tunnel was brought off-line.

QS61B TUNNEL OPERATING PROCEDURE

1. The flap was set at 0 deg.
2. Auxillary Start - the tunnel was pumped down to 20 inches of Hg for S-V check.
3. The tunnel was evacuated until the total pressure was 6 inches of Hg and $M = 1.5$.
4. The total pressure was increased to 30 inches of mercury and the Mach number was established at 1.8.
5. The tunnel was pumped down to 10.3 inches of Hg for purging.
6. The tunnel total pressure was increased to 36.9 inches of Hg.
7. ϕ_F was increased to 41.6 deg.
8. Data were taken at $M = 1.8$, $q = 980$ or 1030 psf depending on configuration.
9. ϕ_F was increased to 55.7 deg.
10. Data were taken at $M = 1.8$, $q = 980$ or 1030 psf depending on configuration, and $\phi_F = 55.7$ deg.
11. ϕ_F was decreased to 0 deg.
12. The tunnel total pressure was decreased to 6.5 inches of Hg.
13. The tunnel was pumped to atmospheric pressure.
14. Tunnel was brought off-line.

0862A TUNNEL OPERATING PROCEDURE

1. The flap was set at 18 deg.
2. The tunnel was evacuated until the total pressure was 15 inches of Hg.
3. The drive motors were started and the flow established at $M = .84$.
4. The tunnel total pressure was increased from 15 inches of Hg to 34 inches of Hg.
5. Data were taken at $M = .84$, $q = 750$ psf and $\phi_F = 18$ deg.
6. ϕ_F was increased from 18 to 24 deg.
7. Data were taken at $M = .84$, $q = 750$ psf and $\phi_F = 24$ deg.
8. ϕ_F was decreased from 24 deg to 18 deg.
9. Tunnel was brought off-line.

0863 TUNNEL OPERATING PROCEDURE

1. The flap was set at 0 deg.
2. Auxillary Start - the tunnel was pumped down to 20 inches of Hg for S-V check.
3. The tunnel was evacuated until the total pressure was 6 inches of Hg and $M = 1.5$.
4. The total pressure was increased to 30 inches of mercury and the Mach number was established at 1.8.
5. The tunnel was pumped down to 10.3 inches of Hg for purging.
6. The tunnel total pressure was increased to 36.9 inches of Hg.
7. ϕ_F was increased to 41.6 deg.
8. Data were taken at $M = 1.8$, $q = 1030$ psf, and $\phi_F = 41.6$ deg.
9. ϕ_F was increased to 55.7 deg.
10. Data were taken at $M = 1.8$, $q = 1030$ psf, and $\phi_F = 55.7$ deg.
11. ϕ_F was decreased to 0 deg.
12. The tunnel total pressure was decreased to 6.5 inches of Hg.
13. The tunnel was pumped to atmospheric pressure.
14. Tunnel was brought off-line.

DATA REDUCTION

Standard tunnel equations were used for computing all tunnel conditions.

Local fluctuating pressure characteristics were calculated by Equations (1) and (2).

$$C_{P_{RMS}} = \frac{144}{q} \frac{\text{RMS NOVA Counts}}{K3 \times \text{GAIN}} \quad (1)$$

$$\text{dB} = 20 \log \frac{P'}{0.29 \times 10^{-8}} \quad (2)$$

Local static pressure data were calculated using Equation (3).

$$C_p = \frac{(P_i - P) \times 144}{q} \quad (3)$$

REFERENCES

1. Marroquin, J., "Pretest Information for Test OS60 (Model 96-Ø) in the Ames Research Center Unitary Plan Wind Tunnel to Certify the Gap Filler for Reuse to Support STS-2." Rockwell Report STS-81-0467, June 1981.
2. Marroquin, J., "Pretest Information for Tests OS61A and OS61B (Models 96-Ø & 81-Ø) in the NASA Ames Research Center Unitary Plan Wind Tunnel (Gap Filler Reuse)." Rockwell Report STS-81-0529, July 1981.
3. Marroquin, J., "Pretest Information for Tests OS62 and OS63 (Models 96-Ø and 81-Ø) in the Ames Research Center (ARC) Unitary Plan Wind Tunnel (UPWT) Ames Gap Filler Reuse Tests of Articles RT-2 Nos. 1,2,3, and 4." Rockwell Report STS-81-0695, December 1981.

TABLE I. TEST RUN SCHEDULES

TEST	CONFIG	RUN	SEQ	MACH	Q psf	P _T psi	θ _F deg
OS60	RT-3	2	1	.75	654	16.64	18°
		2	2	.80	701	16.64	18
		2	3	.82	723	16.64	18
		2	4	.84	742	16.64	18
		2	5	.87	774	16.64	18
		2	7	.87	775	16.64	18
		2	8	.87	777	16.64	18
OS61 A	RT-4-001	2	-	.85	756	16.64	18
			-	.85	757	16.64	24
OS61 B	RT-4-004	2	43	1.80	980	17.24	41.81
			44	1.80	975	17.16	56.07
	RT-4-003	4	47	1.80	1032	18.15	41.81
			48	1.80	1028	18.09	56.07
	RT-4-002	6	50	1.80	1026	18.06	41.97
			51	1.80	1026	18.05	56.23
	RT-2-003	8	54	1.80	1032	18.15	41.97
			55	1.80	1034	18.18	55.90
OS62	RT-2-001	2	1	.83	468	10.55	18
			2	.84	473	10.56	24
OS62 A	RT-2-001	12	-	.84	759	16.96	18
				.84	762	16.96	24
OS63	RT-2-002	4	3	1.80	1032	18.16	41.7
			4	1.80	1031	18.14	55.6
	RT-2-003	3	2	1.80	1030	18.13	41.7
			3	1.80	1032	18.16	55.8
	RT-2-004	2	2	1.80	1037	18.13	41.8
			3	1.80	1036	18.11	55.8

TABLE II. INSTRUMENTATION LOCATION

Test OS60. RT-3 Test Panel, 96-Ø Fixture

Tap No.	Kulite No.	X-distance	Y-distance
1	202	2.05	16
2		4.05	16
3		5.00	16
4		8.05	16
5	206	10.05	16
6		11.00	16
		12.05	16
7		14.05	16
8	212	16.05	16
		17.00	16
9		18.05	16
10		20.05	16
11		24.05	16
12		36.05	16
13		4.05	-16
14		12.05	-16

TABLE II. (Continued)

Test OS61A. RT-4 96-Ø Test Fixture

Tap No.	X-Distance Tile Leading Edge	Y-Distance Panel Q
1	2.0"	+16"
2	4.0	+16
3	6.0	+16
4	8.0	+16
5	10.0	+16
6	12.0	+16
7	14.0	+16
8	16.0	+16
9	18.0	+16
10	20.0	+16
11	24.0	+16
12	36.0	+16
13	4.0	-16
14	12.0	-16

TABLE II. (Continued)

Test OS61B. 81-0 Test Fixture

Measurement					
X	Type			Y=14.63 Number	Y=-14.63 Number
	Press.	Kulites			
2	x			201	101
5		x		202	102
6	x			203	103
9		x		204	104
10	x			205	105
11		x		206	106
12	x			207	
13		x		208	
14	x			209	107
15		x		210	108
16	x			211	
17		x		212	109
18	x			213	110
19		x		214	111
20	x			215	
21		x		216	112
22	x			217	113
23		x		218	
24	x			219	
25		x		220	114
26	x			221	115
28	x			222	
29		x		223	
30	x			224	
32	x			225	
33		x		226	
34	x			227	
36	x			228	116

24 Pressures

20 Kulites

TABLE II. (Continued)

Test OS62. 96-Ø Test Fixture

Static Taps		
Y X	-16	+16
0	201	101
1	202	102
2	203	103
4	204	104
6	205	105
8	206	106
10	207	107
12	208	108
14	209	109
16	210	110
18	211	111
20	212	112
24	213	113
30	-	-
36	214	114

TABLE II. (Continued)

Test OS63. 81-Ø Test Fixture Pressure

Measurement

Y X	14.63	-14.63
2	201	101
6	203	103
10	205	105
12	207	
14	209	107
16	211	
18	213	110
20	215	
22	217	113
24	219	
26	221	115
28	222	
30	224	
32	225	
34	227	
36	228	116

TABLE III
QS-60 CHRONOLOGY

ON: June 9, 1981

<u>CLOCK</u> <u>HR:MIN:SEC</u>	<u>EXPOSURE</u> <u>MIN:SEC</u>	<u>EVENT</u>
8:15		Test sample arrived at tunnel - test sample placed in test panel - test panel installed in test fixture.
12:15		Visual plus step and gap inspection by L&T complete.
13:05		Installation photos taken.
13:45		Tunnel doors closed - fixture flap set at 18 deg.
14:26		Drive motors start.
14:33		Rear gap filler moving out.
14:34:28	0:00	Start Exposure: : $q = > 400$ psf, $P_T = 18$ in.Hg, $M = 0.76$
14:39:20	4:52	On condition $P_T = 34$ in. Hg, $M = 0.76$
14:40:08	5:40	$M = 0.78$
14:40:17	5:49	$M = 0.80$
14:40:23	5:55	$M = 0.82$
14:40:28	6:00	$M = 0.83$
14:40:32	6:04	$M = 0.85$
14:40:38	6:10	$M = 0.86$
14:40:50	6:22	$M = 0.87$
14:40:58	7:30	$M = 0.86$ Stabilized
14:42:10	7:42	End data point - starting down
14:43:53	9:24	$q < 400$ psf - end exposure time

TABLE III: (Continued)

OS-62 CHRONOLOGY

ON: February 9, 1982

<u>CLOCK</u> <u>HR:MIN:SEC</u>	<u>EXPOSURE</u> <u>MIN:SEC</u>	<u>EVENT</u>
18:00		Test panel in place, flap at 18 deg.
18:45		Step and gap complete
19:00		Tunnel closed
19:00		Start tunnel purge
19:35		Purge complete Start pump-down to 25 in Hg
19:45		$P_T = 25$ in. Hg, start S-V check
20:03		S-V OK, start auxiliary equipment
20:04		Start pump-down from 25 to 15 in Hg
20:10		$P_T = 15.45$ in Hg; $m = 0$; drive start
20:19:15	0:00	$P_T = 18.24$ in Hg, $q = 400$, $m = .84$: start exposure time
20:22	2:45	$P_T = 21.47$ in Hg, $q = 470$, $m = .84$, $\theta = 18^\circ$ data point
	3:30	Change flap to 24 deg.
20:23	3:45	$P_T = 21.47$ in Hg, $q = 470$, $m = .84$, $\theta = 24^\circ$ data point
	4:30	Change flap to 18 $^\circ$ deg.
	4:45	Start to reduce rpm of drive
20:25	5:45	$P_T = 21$ in Hg, $q = 400$, $m =$: end exposure time
20:26		Drive stop
20:30		S-V check
20:34		Off-Line
20:37		Tunnel open

TABLE III. (Continued)

OS62A CHRONOLOGY

ON: March 3, 1982
 TEST ARTICLE: RT-2 No. 1

CLOCK			EXPOSURE	EVENT
HR:	MIN:	SEC.	MIN:SEC	
02:	03:	00		Tunnel closed - started pumping for S-V check
02:	07:	00		S-V checked O.K. - started purge
02:	40:	00		Aux start. still purging
04:	45:	00		Off purge
03:	00:	00		Pumping down to 15 inches Hg.
03:	02:	00		$P_T = 24$ inches Hg
03:	02:	30		Drive start $P_T = 23$ inches Hg
03:	03:	30		$M = .4$ $P_T = 22.6$ inches Hg
03:	05:	00	00:00	Start exposure time: $q = 400$ psf
03:	06:	30	01:30	$M = .81$ $P_T = 23$ inches Hg
03:	07:	30	02:30	$M = .82$ $P_T = 27$ inches Hg
03:	08:	00	03:00	$M = .84$ $P_T = 29$ inches Hg
03:	09:	00	04:00	$M = .84$ $P_T = 32$ inches Hg
03:	09:	30	04:30	$M = .84$ $P_T = 34$ inches Hg
03:	10:	00	05:00	θ_F changed from 18 deg to 24 deg
03:	10:	15	05:15	$M = .84$ $P_T = 34$ inches Hg
03:	10:	30	05:30	θ_F changed from 24 deg to 18 deg, shutting down
03:	11:	00	06:00	$M = .82$ $P_T = 34$ inches Hg
03:	12:	00	07:00	$M = .75$ $P_T = 30$ inches Hg
03:	12:	30	07:30	$M = .65$ $P_T = 30$ inches Hg
03:	13:	00	08:00	$M = .6$ $P_T = 30$ inches Hg, end exposure time
03:	13:	30		$M = .5$ $P_T = 30$ inches Hg
03:	14:	30		Drive stop $M = .4$ $P_T = 30$ inches Hg
03:	17:	30		Aux stop
03:	18:	00		Tunnel door open

TABLE III. (Continued)

QS 63 CHRONOLOGY

ON: February 23, 1982
 TEST ARTICLE: RT-2 No. 4

<u>CLOCK</u> <u>HR:MIN:SEC</u>	<u>EXPOSURE</u> <u>MIN:SEC</u>	<u>EVENT</u>
00:00:		Took static readings with static meter
00:30: 00		Tunnel closed
00:45: 00		Aux start pump down to 20 in Hg
00:49: 00		S-V checked O.K.
00:58: 00		Began pump down for start
01:15: 00		Aux stop - problem with shock panel and water in pit
02:58: 00		Aux start and pump down
03:05: 00		Drive start
03:06: 00		Started TV recorder
03:10: 00		Tunnel start $M = 1.5$ $P_T = 6.2$ inches Hg.
03:15: 00		Increased M to 1.8 and P_T to 29.8 inches Hg. Pumped down for purge.
03:20: 00		$M = 1.8$, $P_T = 14.3$ inches Hg, $q = 400$ psf
03:25: 00		$M = 1.8$, $P_T = 5.9$ inches Hg
03:27: 00		$M = 1.8$, $P_T = 14.3$ inches Hg, $q = 400$ psf
03:28: 00		$P_T = 20$ inches Hg
03:29: 00		$P_T = 25$ inches Hg
03:30: 00		$P_T = 30$ inches Hg
03:31: 00		$P_T = 36.9$ inches Hg, $M = 1.8$, $\phi_F = 0$
03:32: 00	00:00	$P_T = 36.9$ inches Hg, $M = 1.8$, $\phi_F = 41.6$: start exposure time
03:33: 00	01:00	$P_T = 36.9$ inches Hg, $M = 1.8$, $\phi_F = 55.7$ deg
03:34: 00	02:00	Start down $\phi_F = 0$ deg: end exposure time
03:35: 00		$P_T = 30$ inches Hg, M decreasing to 1.5
03:36: 00		$P_T = 25$ inches Hg
03:38: 00		$P_T = 20$ inches Hg
03:40: 00		$P_T = 14.3$ inches Hg, $q = 400$ psf
03:43: 00		$P_T = 7.5$ inches Hg, $M = 1.5$, lost shock
03:45: 00		Drive stop
03:50: 00		Aux stop
03:52:00		Tunnel open

TABLE III. (Continued)

Q563 CHRONOLOGY

ON: February 23, 1982
 TEST ARTICLE: RT-2 No. 3

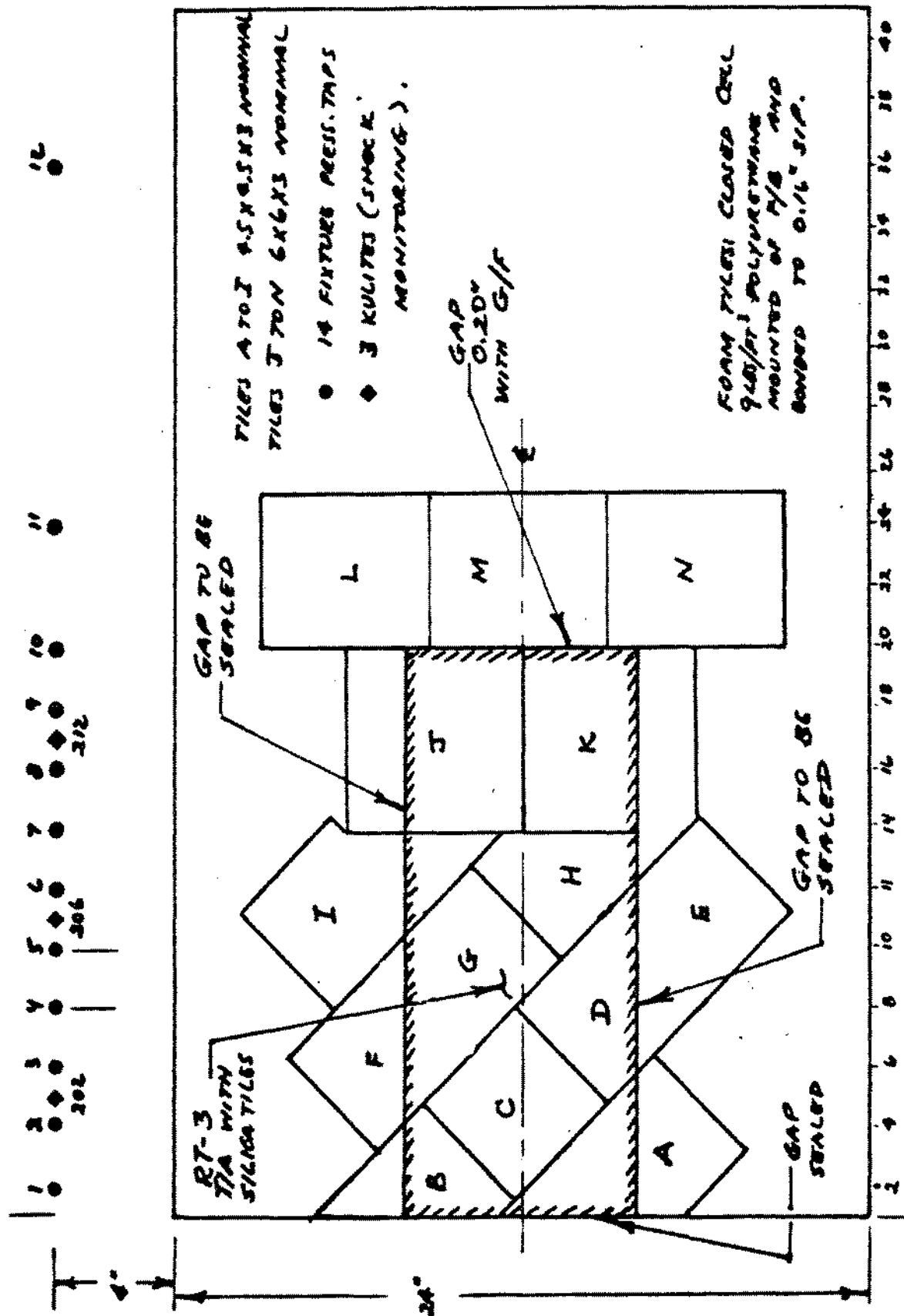
<u>CLOCK</u> <u>HR:MIN:SEC</u>	<u>EXPOSURE</u> <u>MIN:SEC</u>	<u>EVENT</u>
08:03:00		Aux start - pump down to 20 inches Hg
08:07:00		S-V check, $P_T = 22.69$ inches Hg, Tap No. 110 had a partial lead
08:14:00		Drive start
08:20:00		Tunnel went supersonic, P_T passed through 14 inches Hg, $q = 400$ psf
08:24:00		$M = 1.8$, $P_T = 30$ inches Hg
08:25:00		$M = 1.8$, $P_T = 36$ inches Hg
08:27:00	00:00	$M = 1.8$, $P_T = 36$ inches Hg, changed θ_F from 0 deg to 41.6 deg: start exposure time
08:27:00	00:00	$M = 1.8$, $P_T = 36$ inches Hg, changed θ_F from 41.6 deg to 55.7 deg
08:28:00	01:00	Changed θ_F from 55.7 deg to 0 deg, began to bring tunnel down: end exposure time
08:30:00		$M = 1.5$, $P_T = 24.2$ inches Hg and decreasing
08:33:00		$q = 400$ psf, $P_T = 14.34$ in Hg
08:37:00		Lost shock (tunnel was subsonic)
08:38:00		Drive stop, $P_T = 5.5$ inches Hg and increasing
08:40:00		Aux stop, $P_T = 20.96$ inches Hg and increasing
08:41:00		$P_T = 31.1$ inches Hg
08:45:00		Tunnel open

TABLE III. (Concluded)

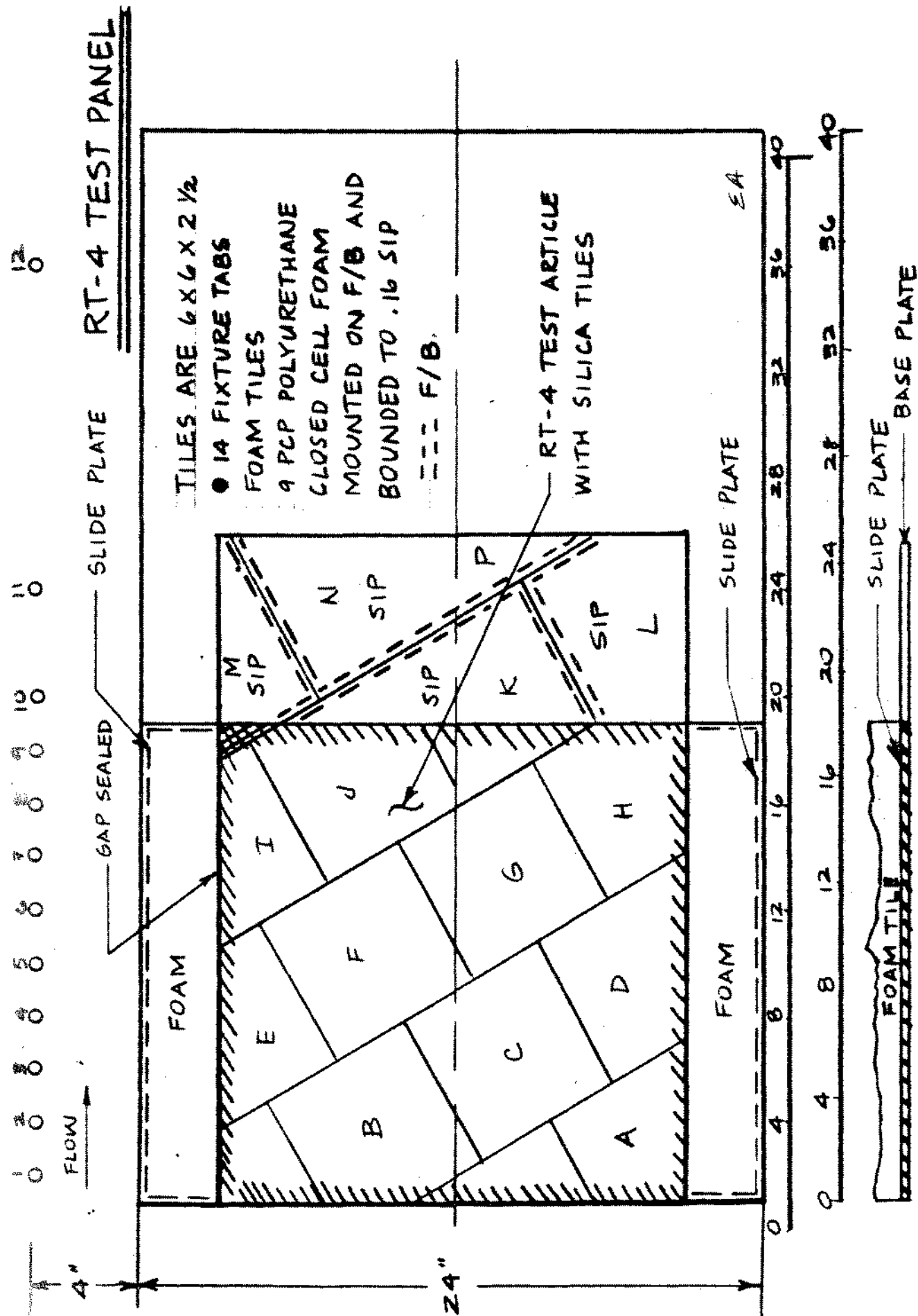
Q863 CHRONOLOGY

ON: February 24, 1982
 TEST ARTICLE: RT-2 No. 2

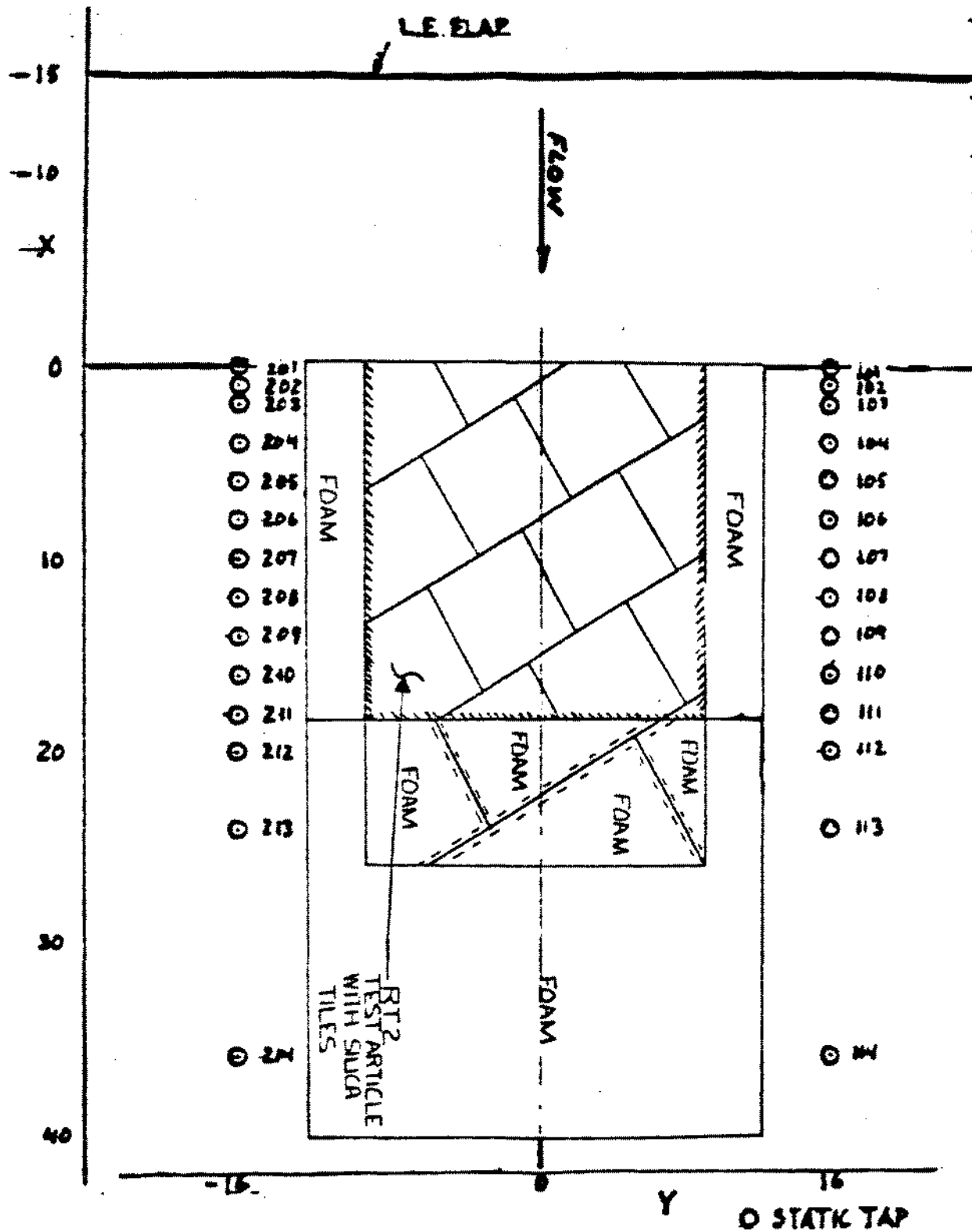
<u>CLOCK</u> <u>HR:MIN:SEC</u>	<u>EXPOSURE</u> <u>MIN:SEC</u>	<u>EVENT</u>
00:23:00		Step measurements began
00:40:00		Tunnel door closed
00:57:00		Aux start - pump down to 20 inches Hg
01:01:00		S-V check, taps 101, 103, 105, 107, 110, and 116 were not any good
01:05:00		Pump down for start
01:09:00		Drive start
01:15:00		M = 1.5, P_T = 6 inches Hg, began pumping to 30 inches Hg.
01:17:00		P_T = 14.5 inches Hg
01:20:00		P_T = 30 inches Hg, M increasing from 1.5 to 1.8, began to pump down for purging
01:19:00		P_T = 14.3 inches Hg, M = 1.8
01:21:00		P_T = 10.3 inches Hg, M = 1.8
01:29:00		P_T = 14.3 inches Hg, q = 400 psf
01:30:00		P_T = 20 inches Hg
01:31:00		P_T = 25 inches Hg
01:32:00		P_T = 30 inches Hg
01:34:00		P_T = 36.9 inches Hg, M = 1.8, θ_F = 0 deg
01:35:00	00:00	P_T = 36.9 inches Hg, M = 1.8, θ_F = 41.6 deg: start exposure time
01:36:00	01:00	P_T = 36.9 inches Hg, M = 1.8, θ_F = 55.7 deg
01:37:00	02:00	P_T = 36.9 inches Hg, M = 1.8, θ_F = 0 deg: end exposure time
01:39:00		P_T = 30 inches Hg, M = 1.8 decreasing to 1.5
01:40:00		P_T = 25 inches Hg, M = 1.5
01:41:00		P_T = 20 inches Hg
01:43:00		P_T = 14.4 inches Hg
01:47:00		P_T = 6.5 inches Hg, lost shock
01:48:00		Drive stop, pumping to ATM
01:51:00		Aux stop
01:54:00		ATM
01:55:00		Tunnel open



a. RT-3 Test Panel
Figure 1. Model Sketches

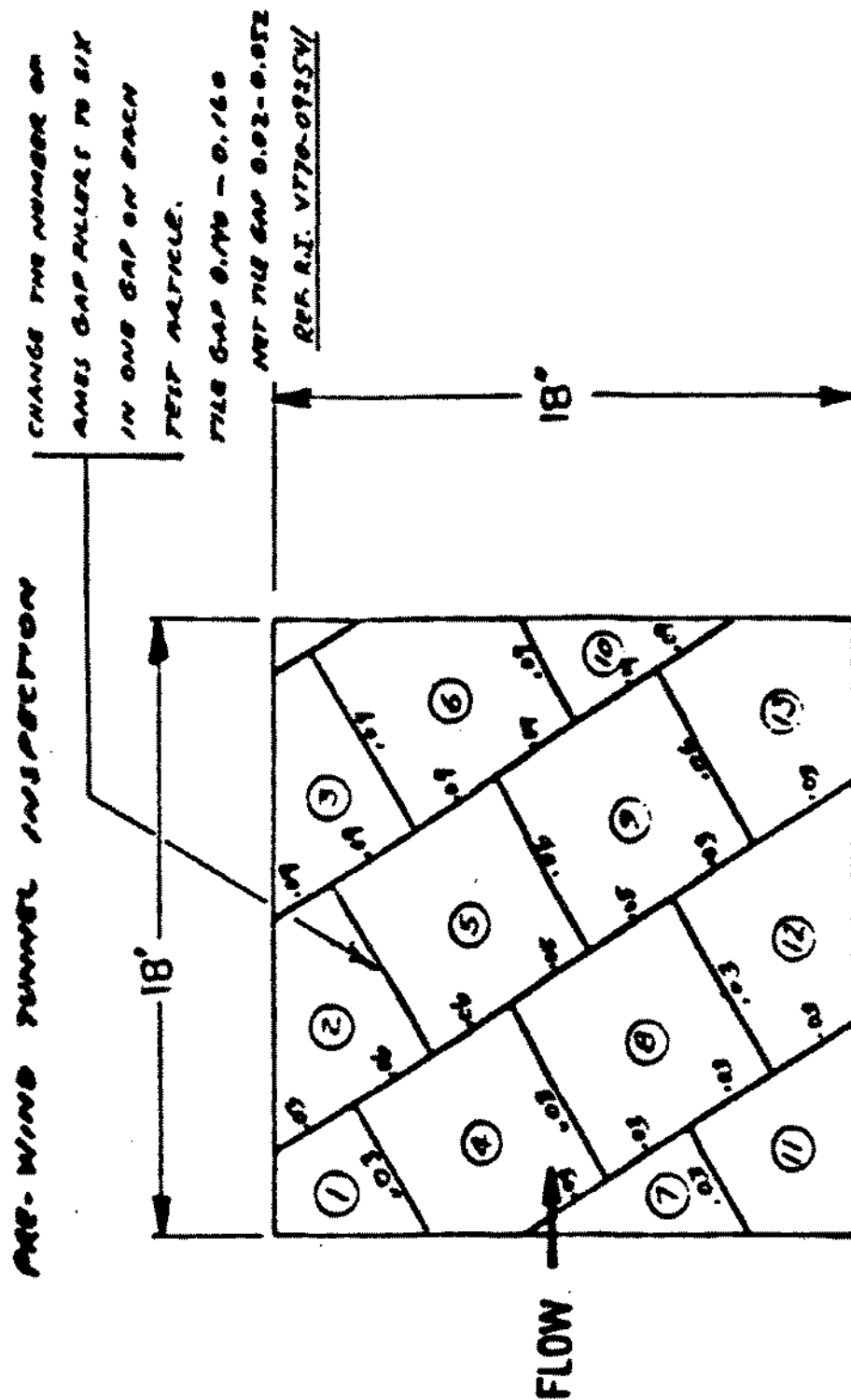


b. RT-4 Test Panel
Figure 1. (Continued)



c. OS62 Instrumentation Locations
Fixture 96-0

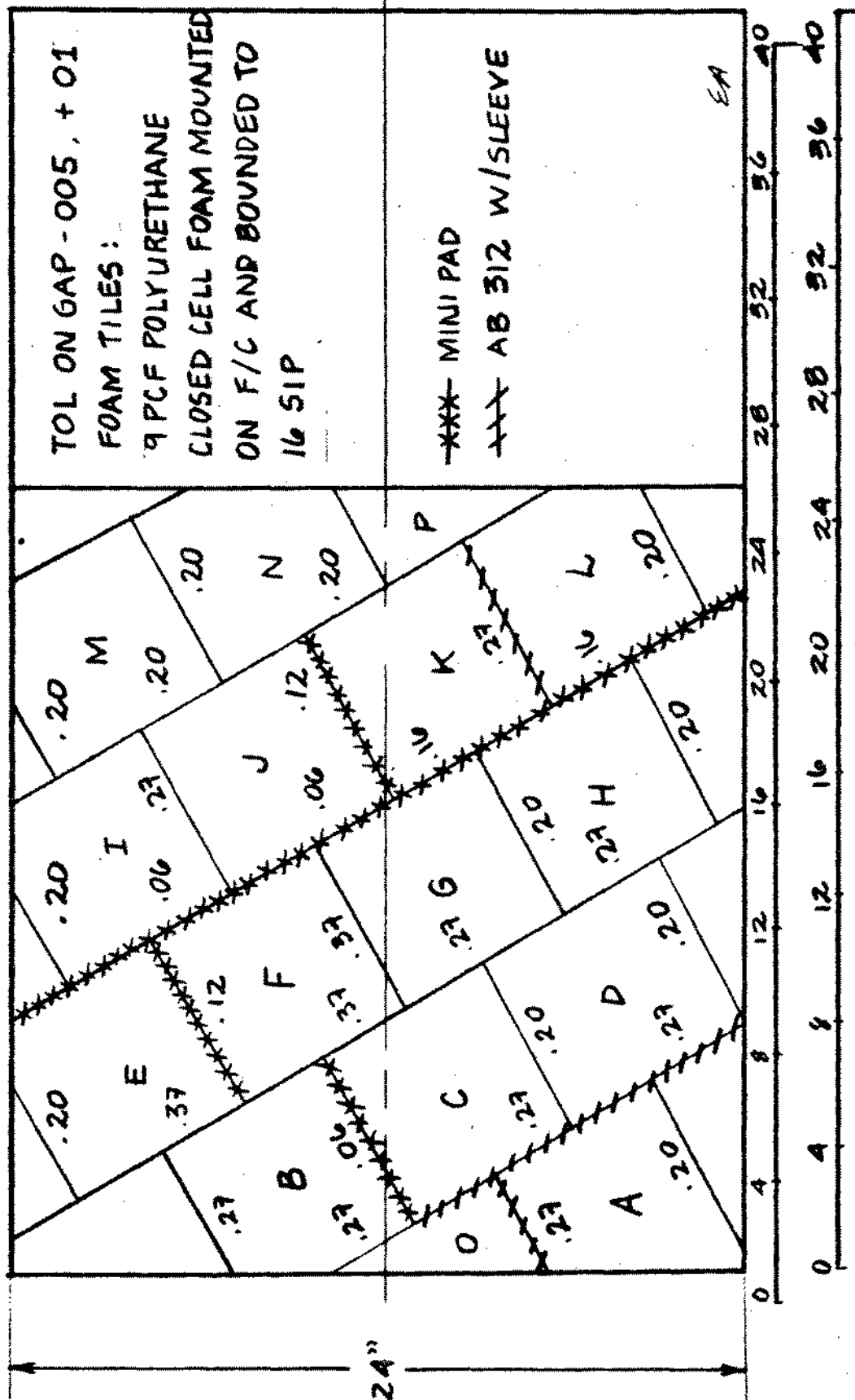
Figure 1. (Continued)



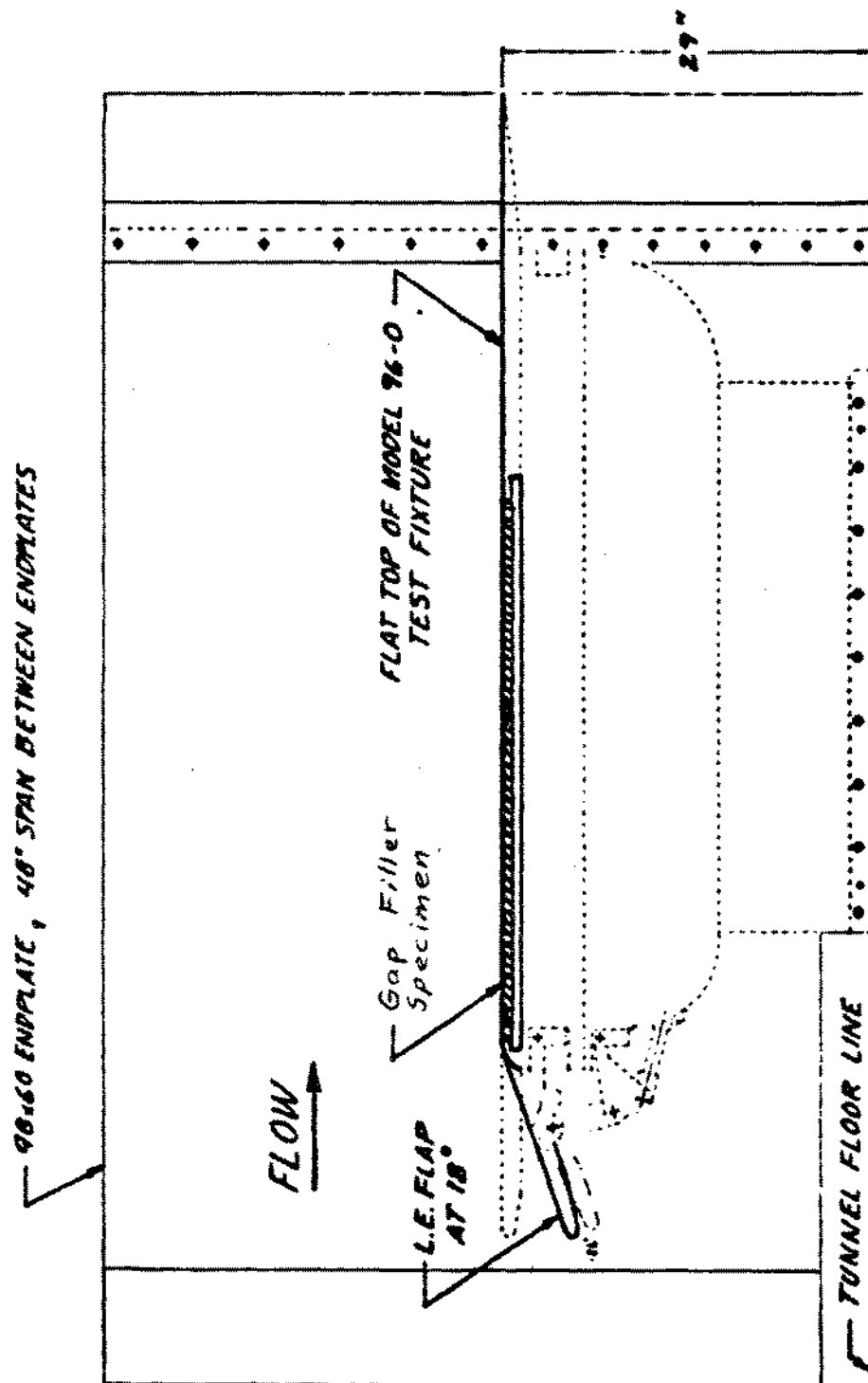
g. RT-2 Panel Cap Definition

Figure 1. (Continued)

FLOW →

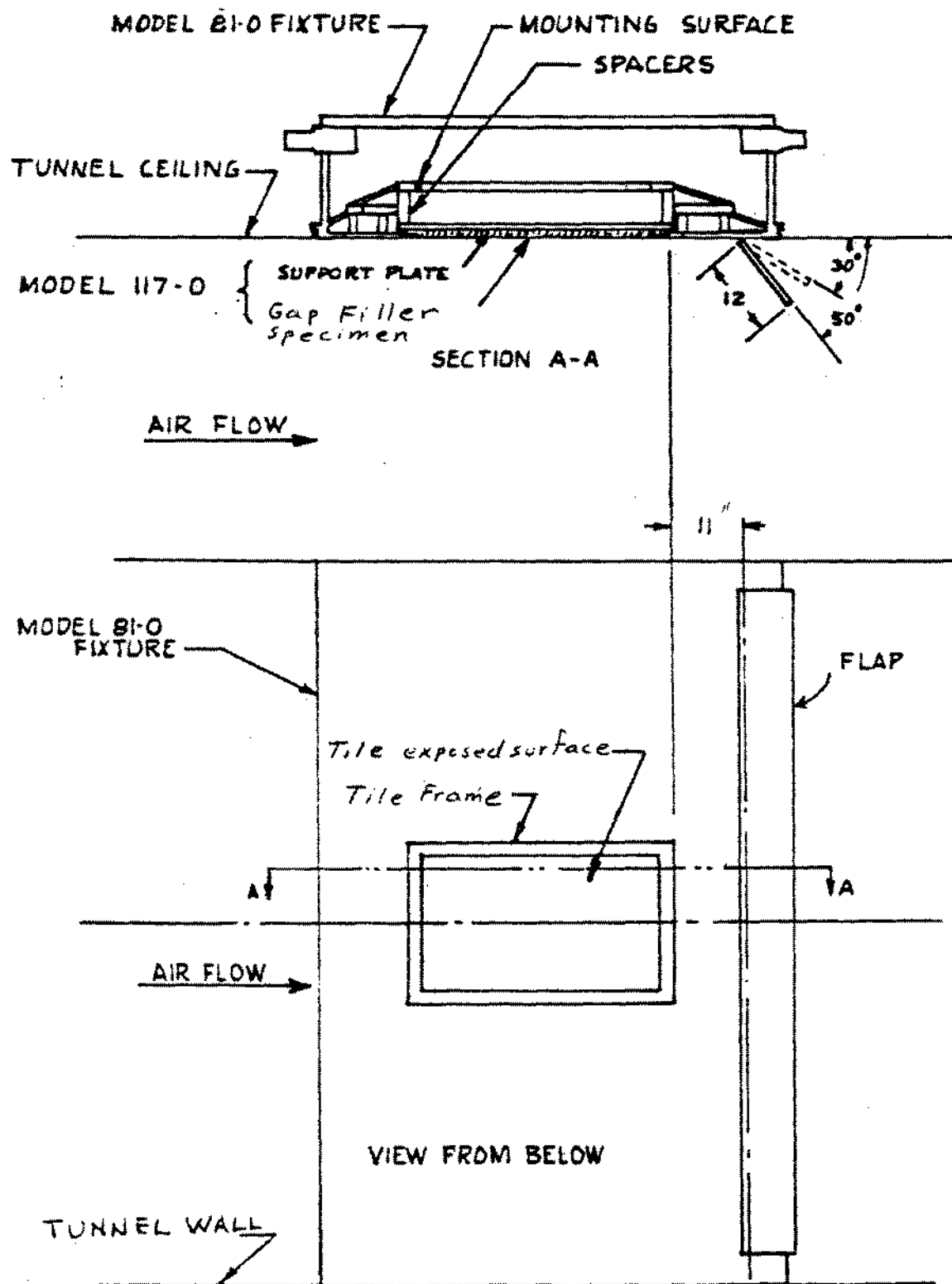


h. RT-4 Panel Gap Definition
Figure 1. (Continued)



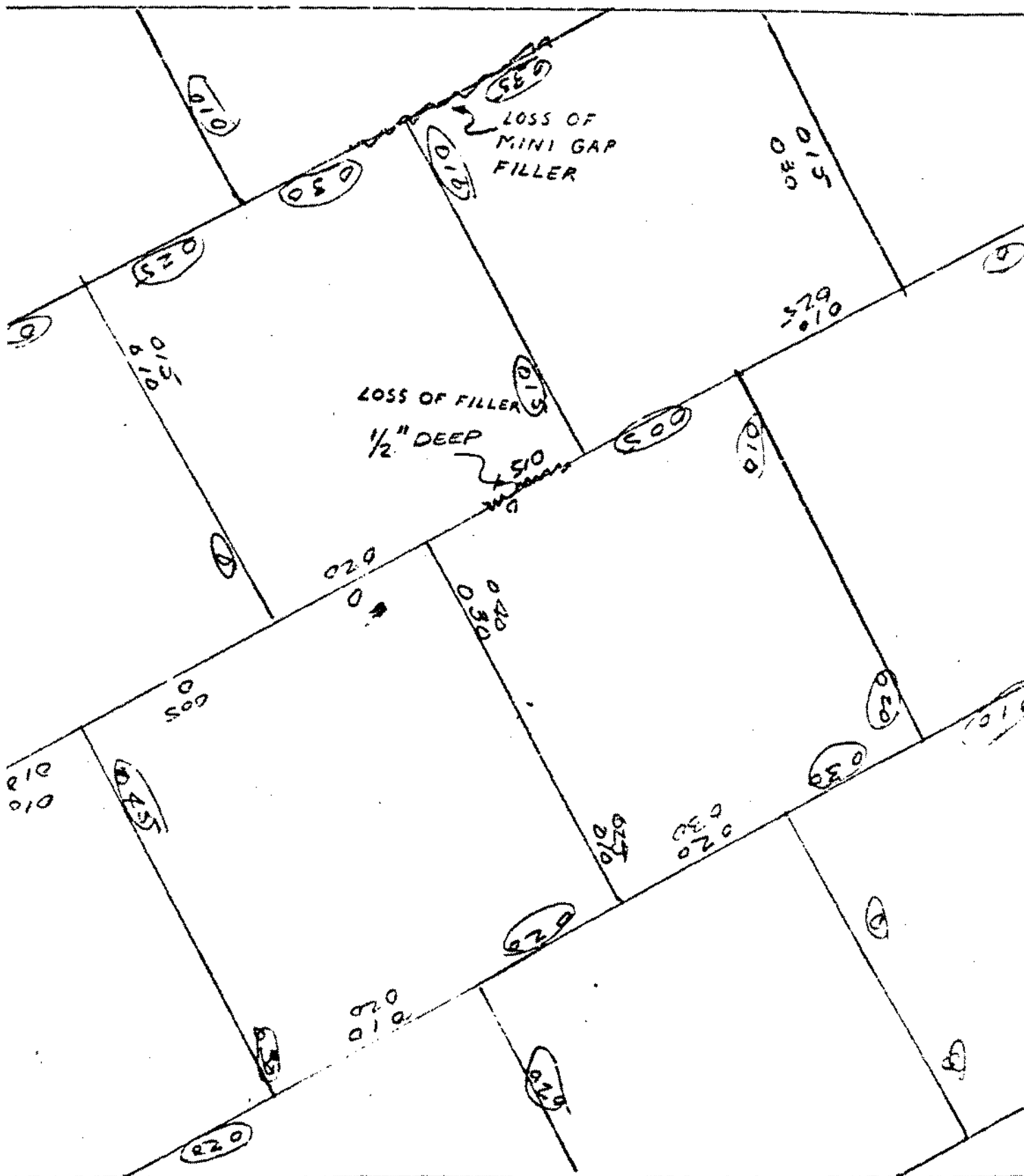
i. Model 96-0 Test Fixture General Arrangement

Figure 1. (Continued)



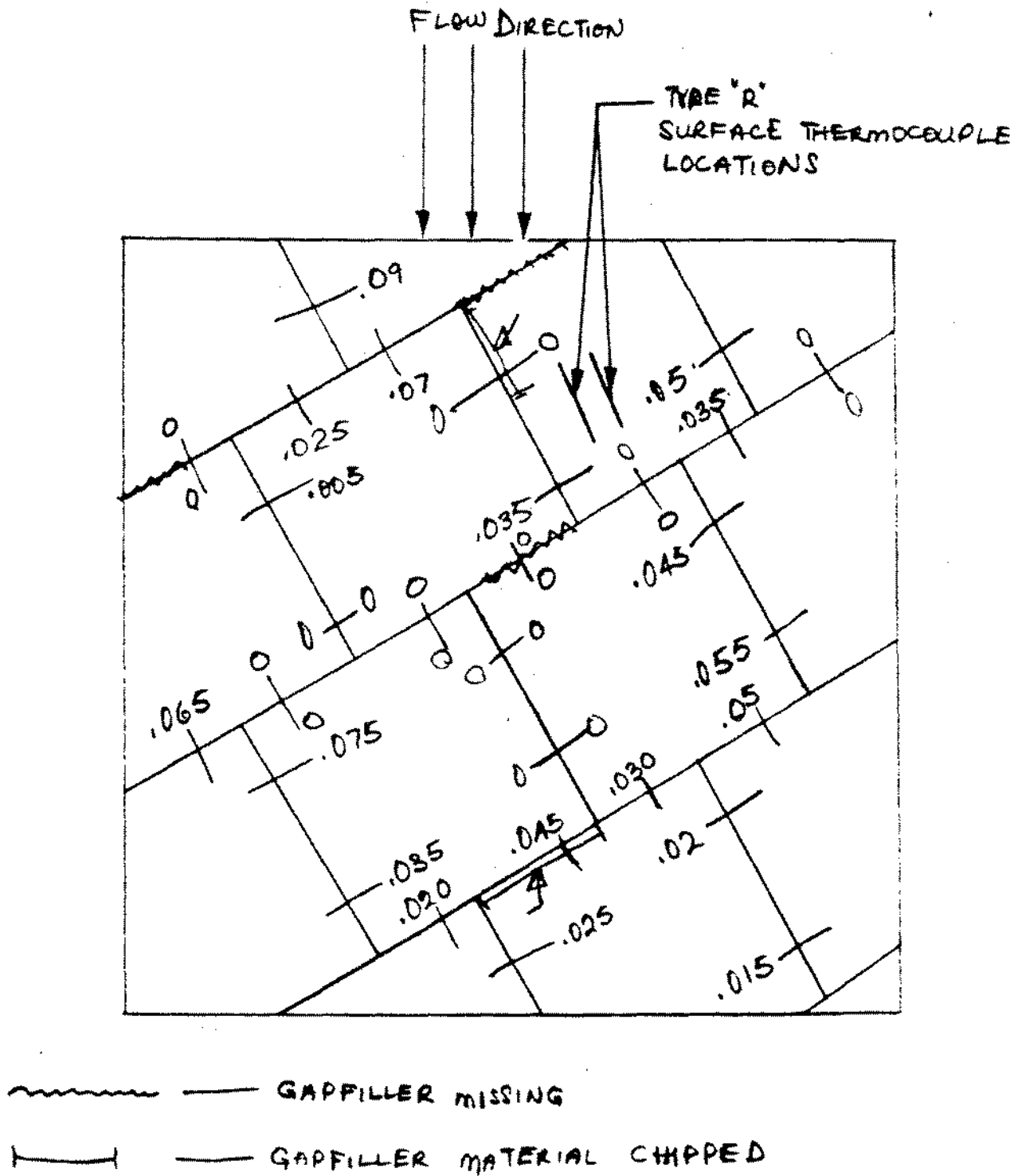
j. Model 81-0 Test Fixture General Arrangement

Figure 1. (Concluded)



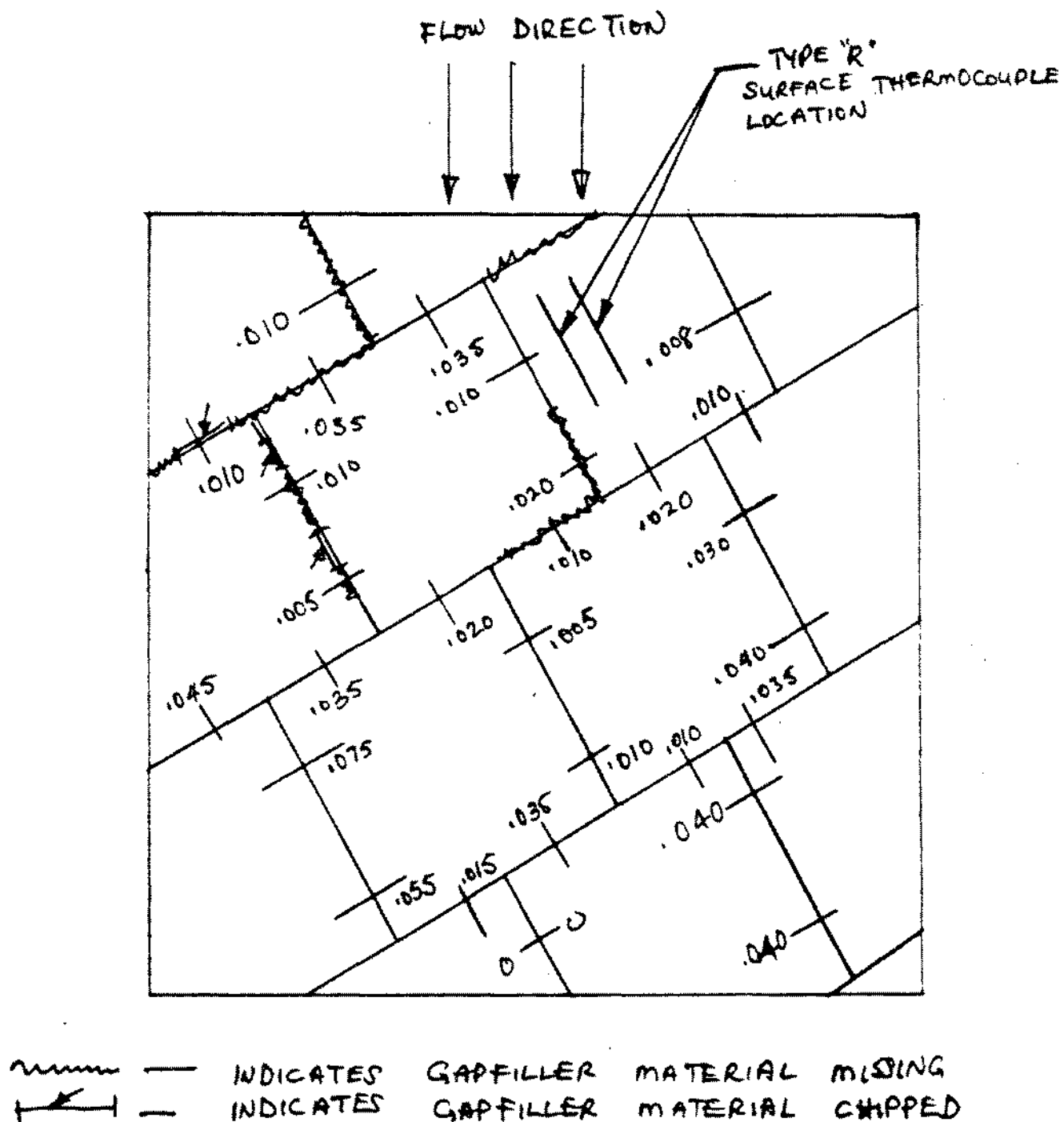
a. OS62 RT-2-001 Step Measurements

Figure 2. Step & Gap Measurements



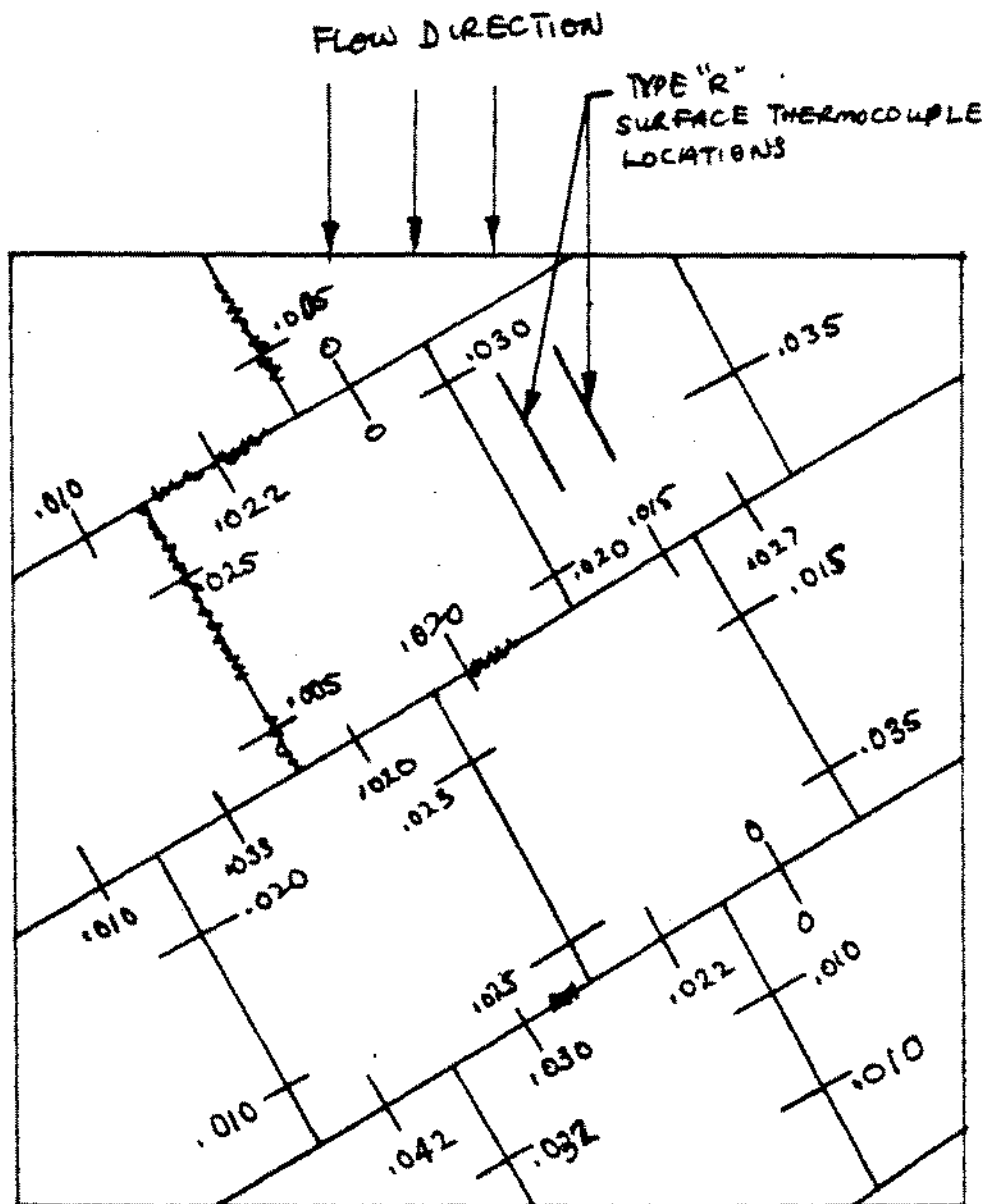
b. OS62A RT-2-001 Step & Gap Measurements (Pre-Test)

Figure 2. (Continued)



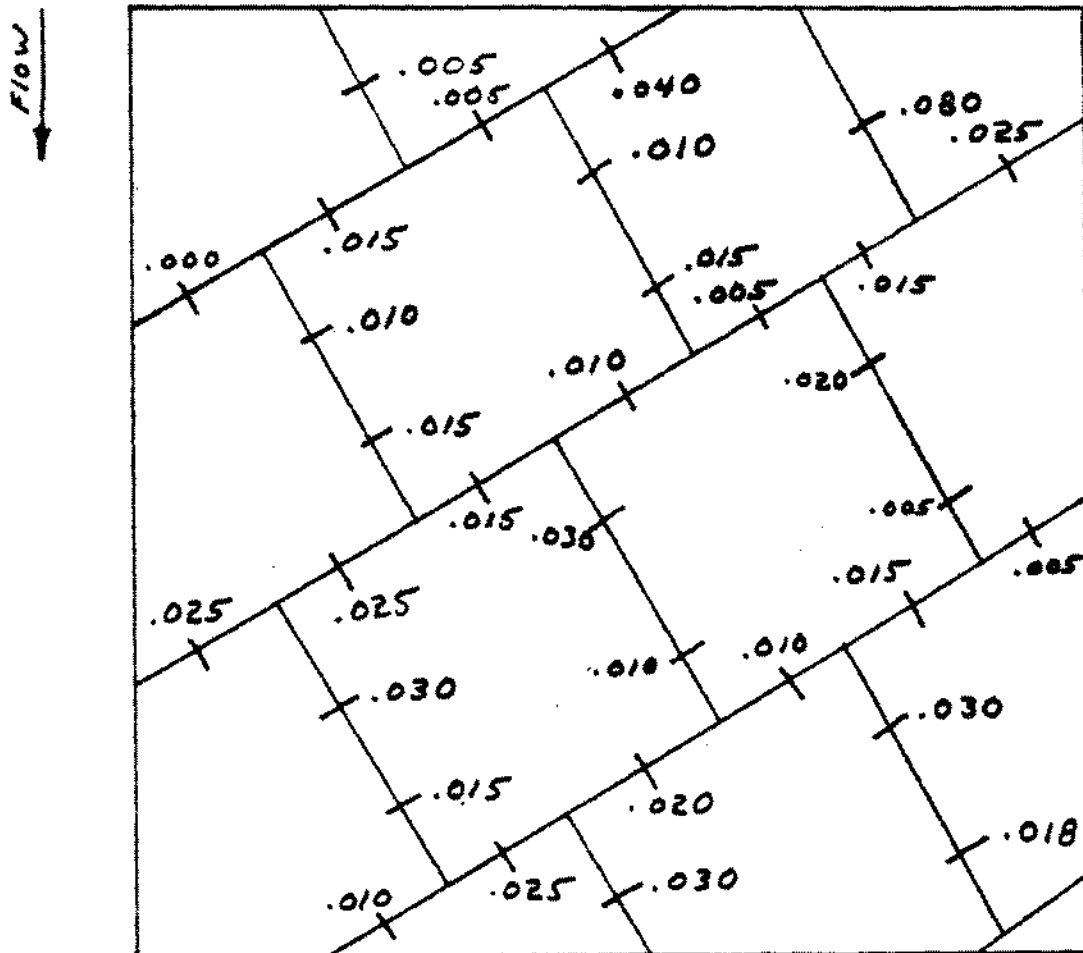
c. OS62A RT-2-001 Step & Gap Measurements (Post-Test)

Figure 2. (Continued)



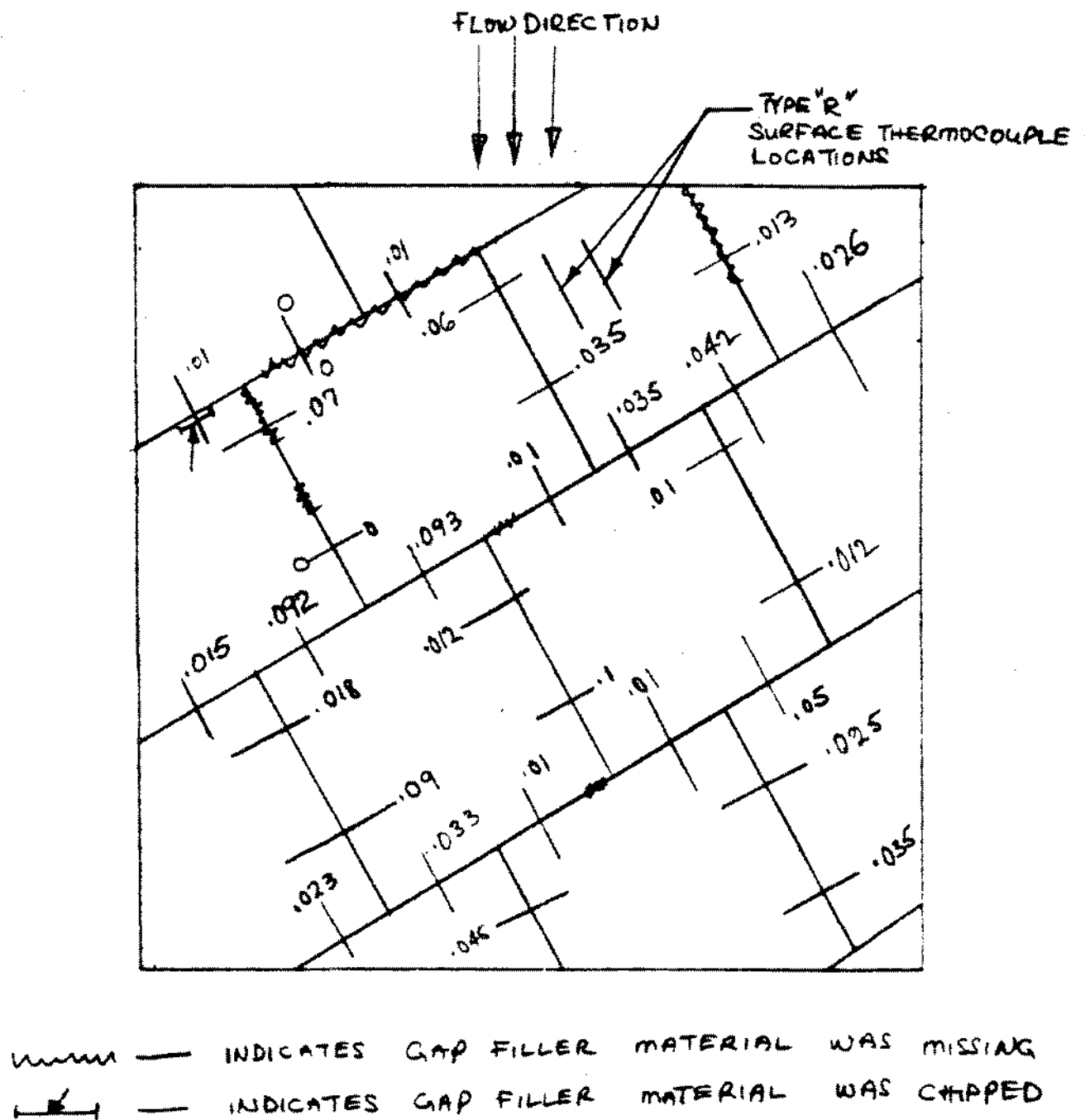
d. OS63 RT-2-004 Step & Gap Measurements (Post-Test)

Figure 2. (Continued)



f. OS63 RT-2-002 Step & Gap Measurements (Pre-Test)

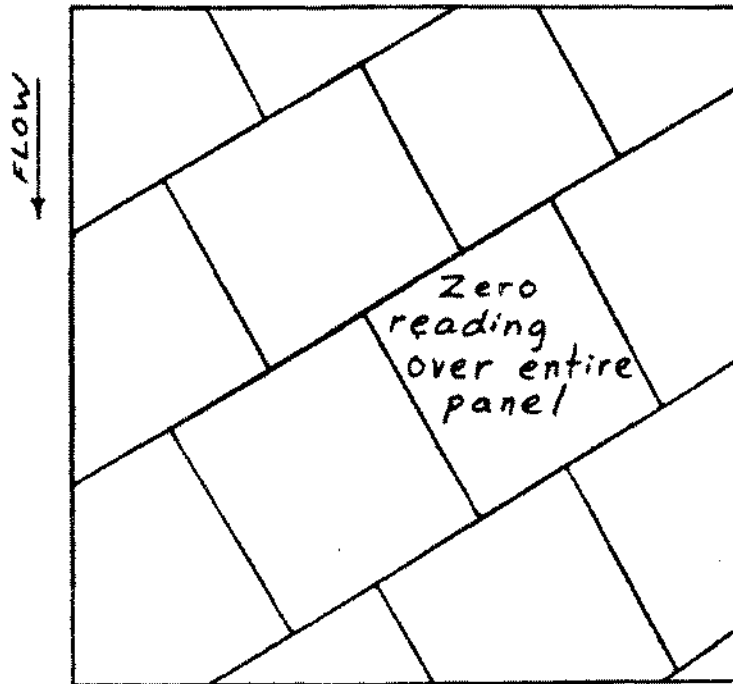
Figure 2. (Continued)



g. OS63 RT-2-002 Step & Gap Measurements (Post-Test)

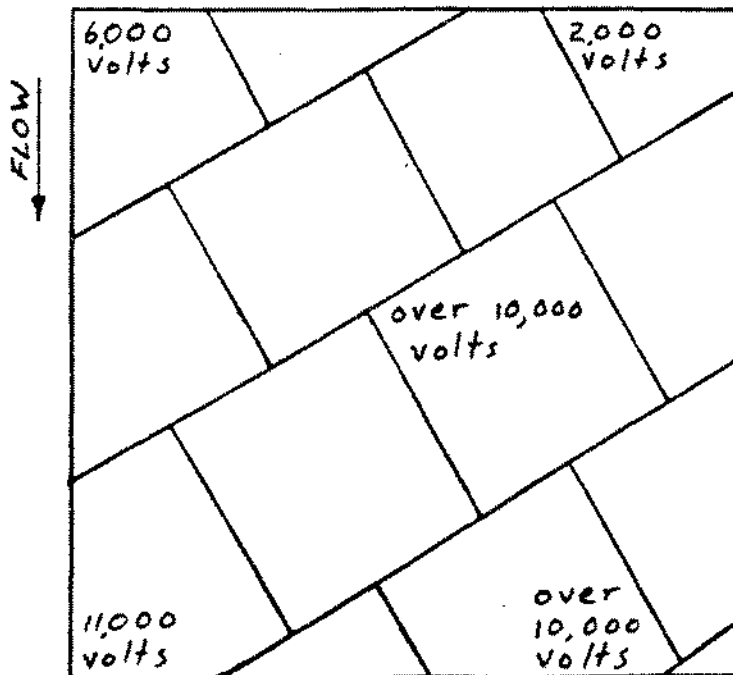
Figure 2. (Concluded)

Before run static readings



Note: Readings were taken at 2" above panel

After run static readings

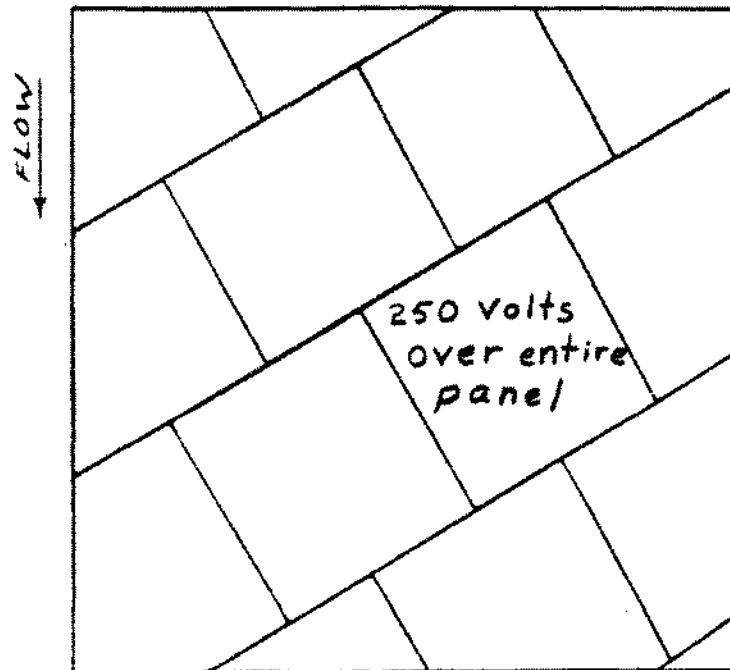


Note: Readings were taken at 12" above panel

a. OS62A RT-2 No.1

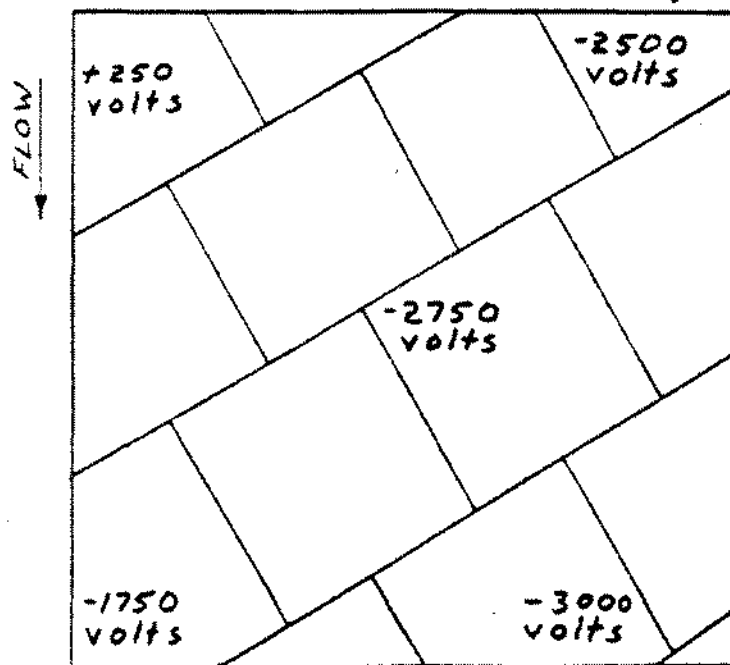
Figure 3. Static Charge Readings

Before run static readings



Note: Readings were taken at
2" above panel

After run static readings

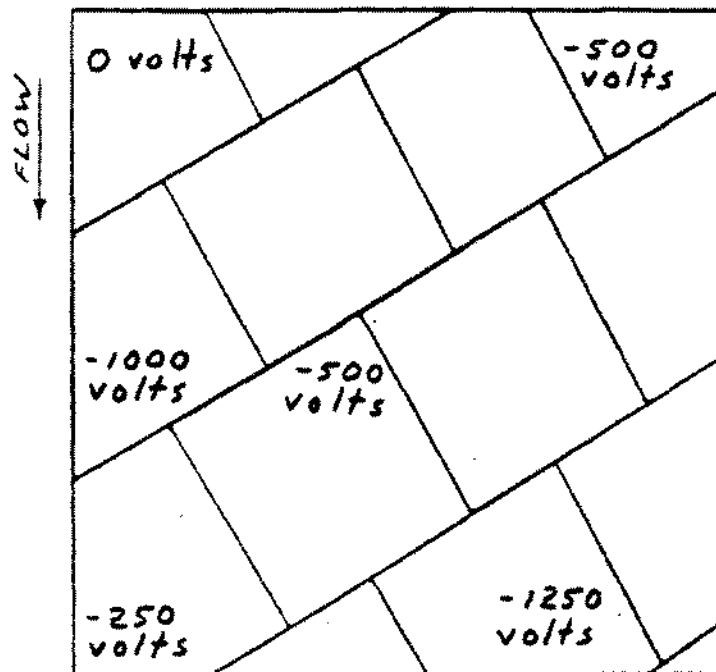


Note: Readings were taken at
6" above panel.

b. OS63 RT-2 No. 4

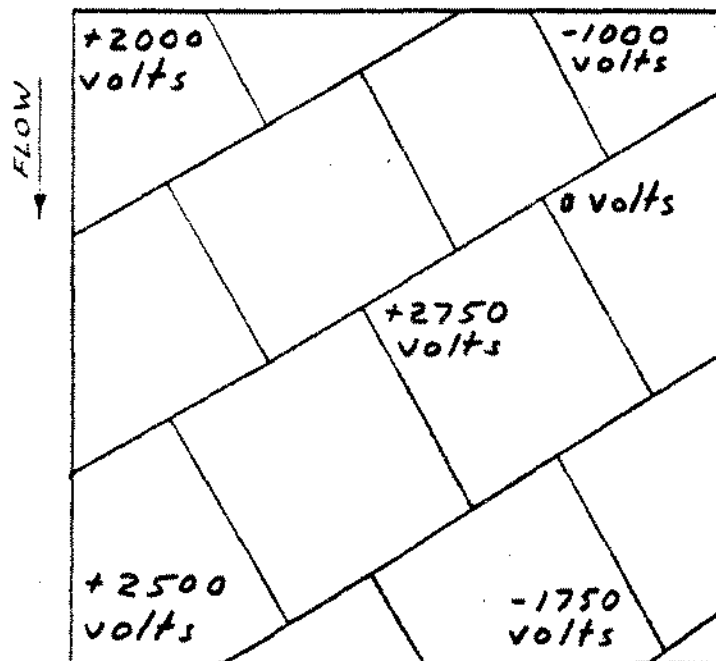
Figure 3. (Continued)

Before run static readings



Note: Readings were taken at 6" above panel

After run static readings

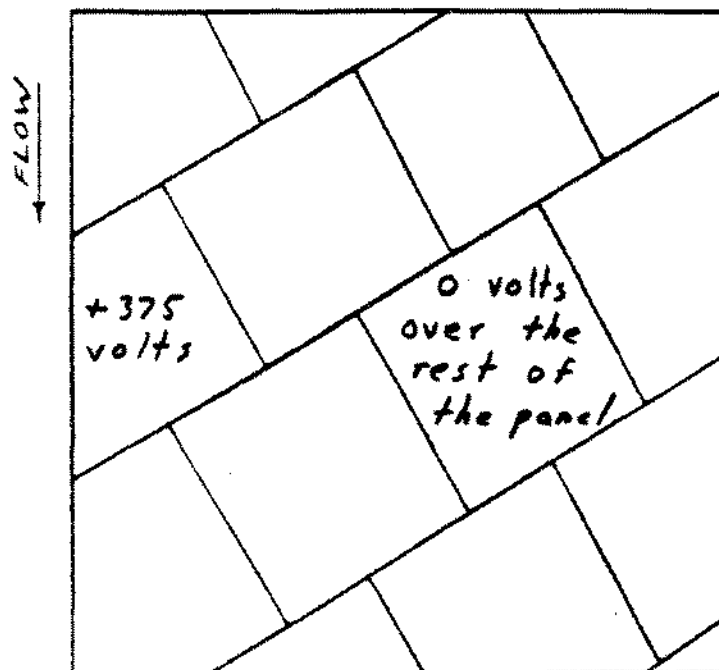


Note: Readings were taken at 6" above panel

c. OS63 RT-2 No.3

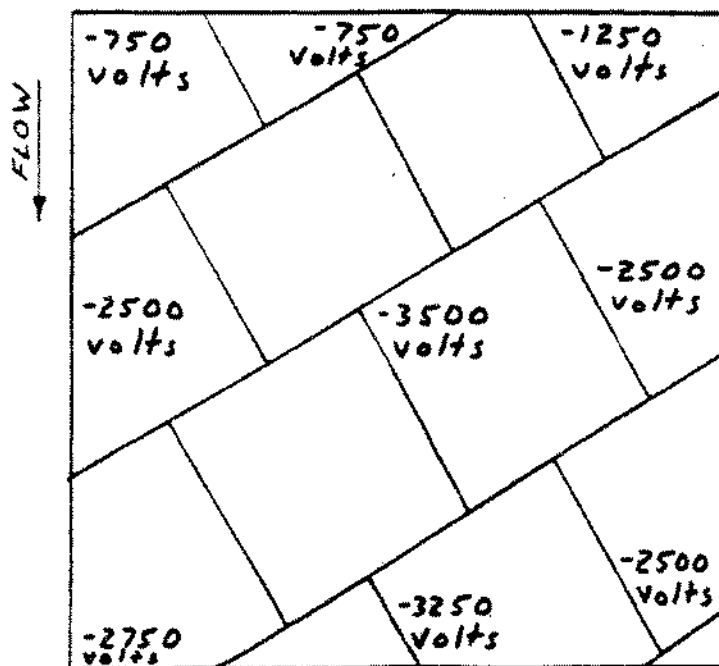
Figure 3. (Continued)

Before run static readings



Note: Readings were taken at 6" above panel

After run static readings



Note: Readings were taken at 6" above panel.

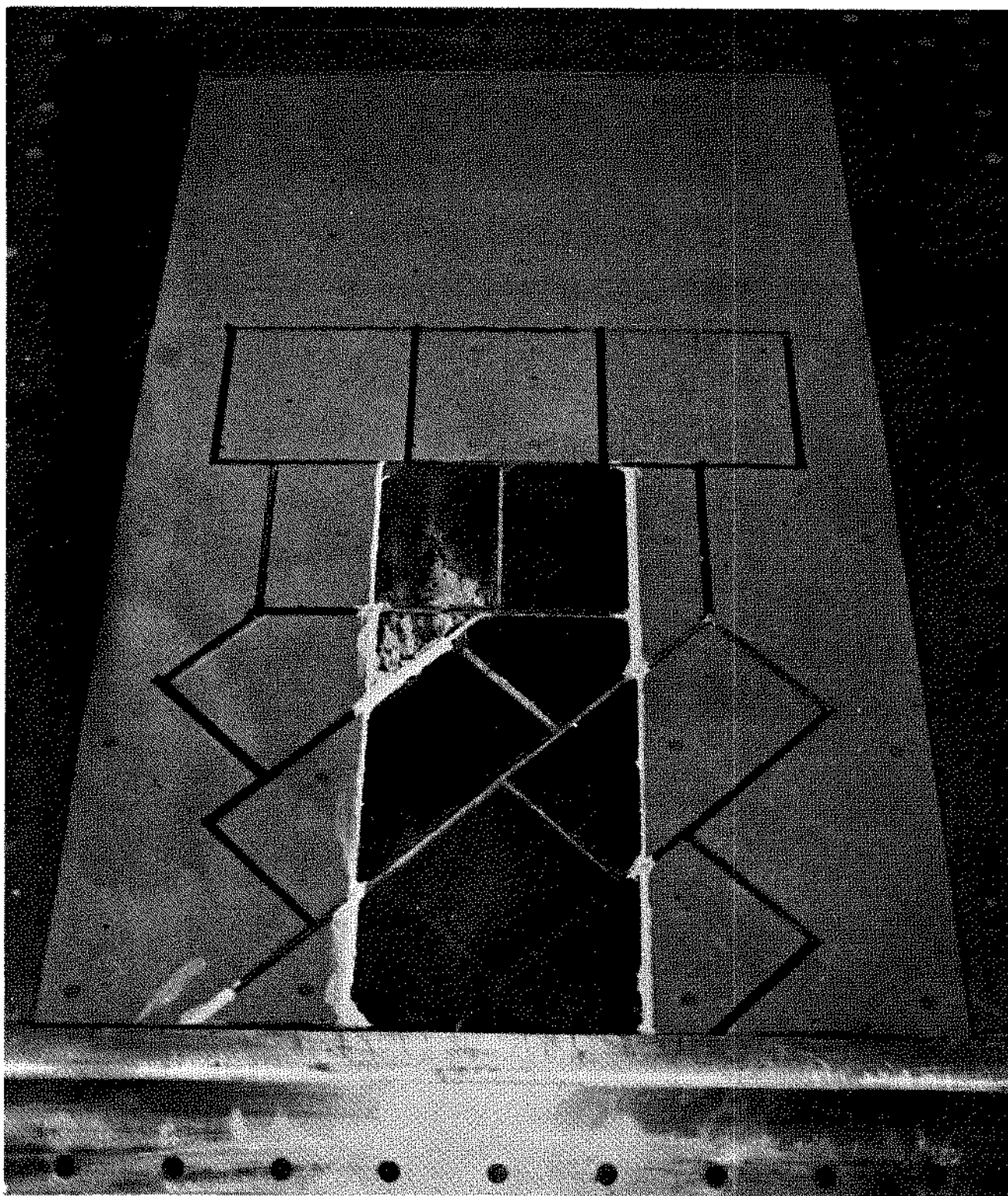
d. OS63 RT-2 No. 2

Figure 3. (Concluded)



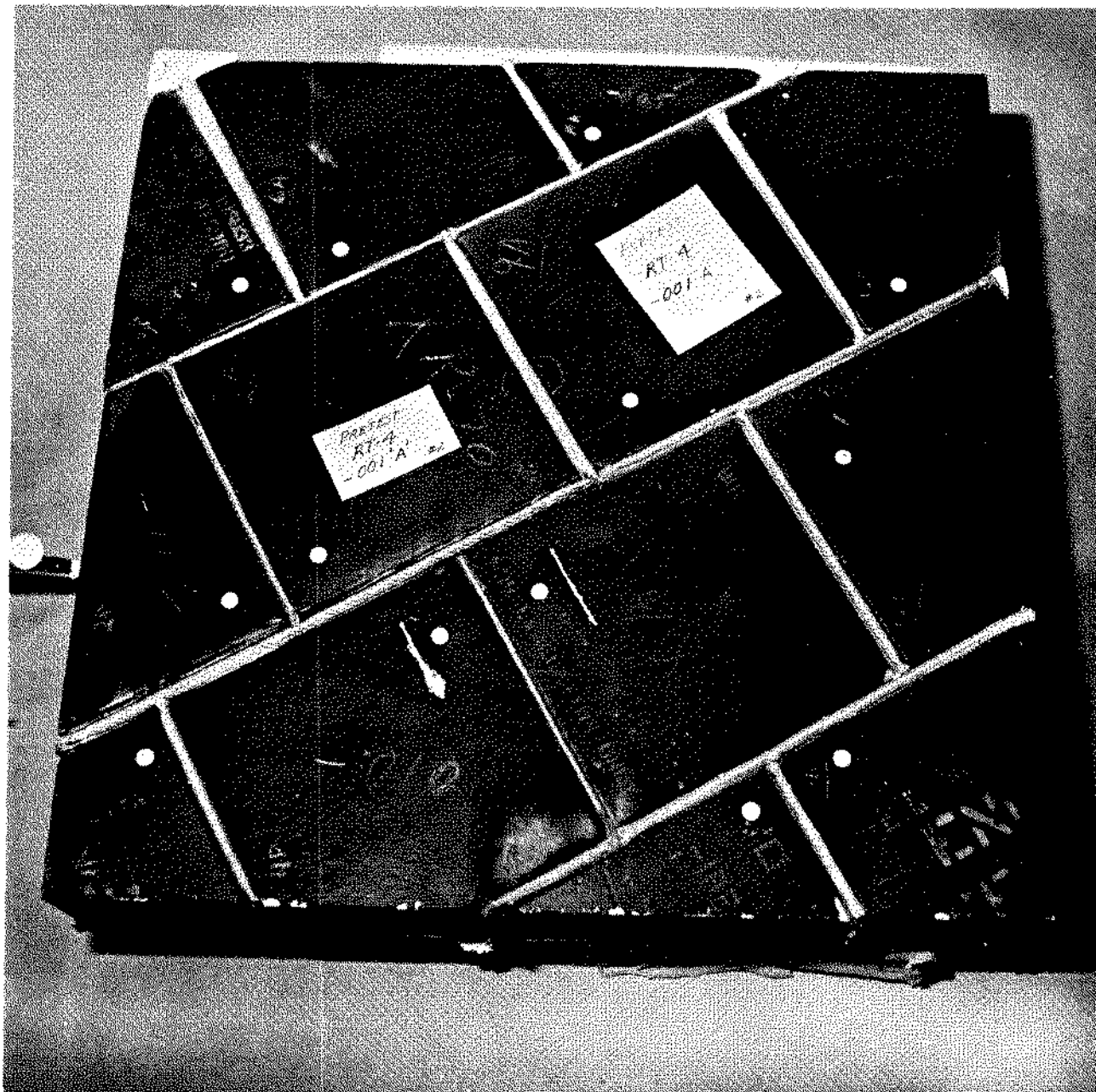
a. OS60-Installation - Fixture 96-Ø

Figure 4. Model Photographs



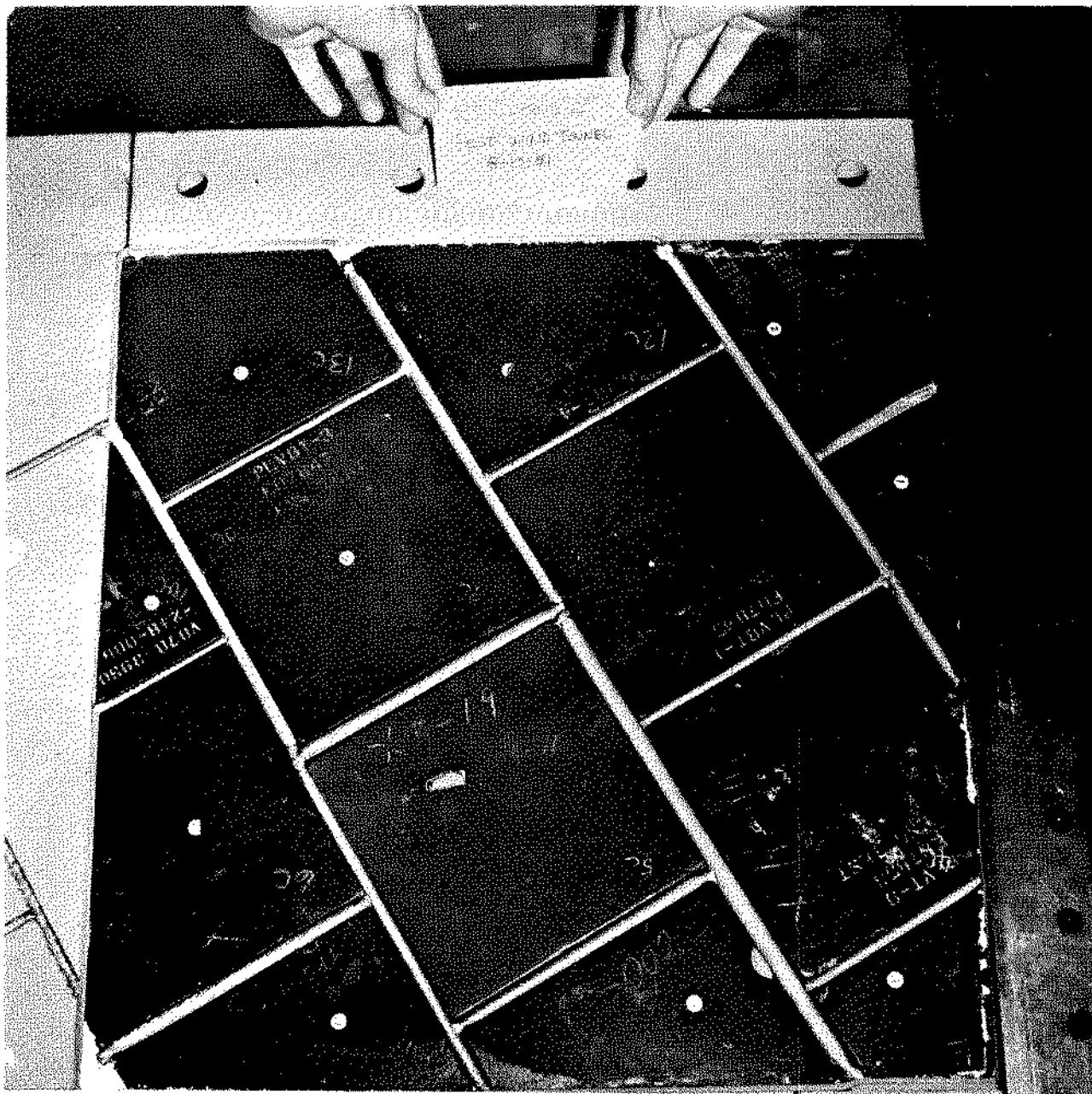
b. OS60-RT-3 Panel

Figure 4. (Continued)



c. OS61B-RT-4-001 Panel - Pre-test

Figure 4. (Continued)



d. OS61B-RT-4-002 Panel - Post-test

Figure 4. (Concluded)

Data Figures

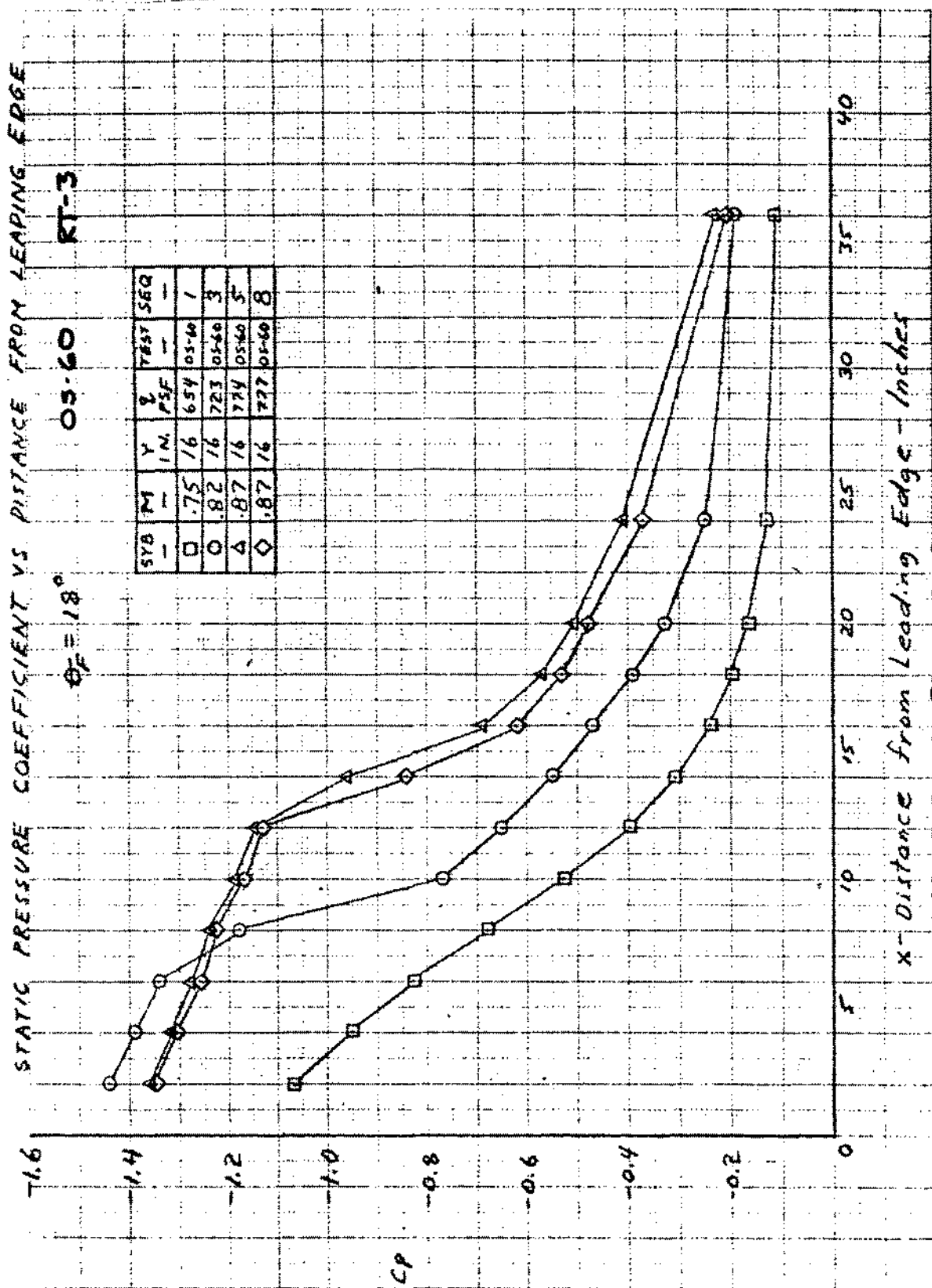


Figure 5 OS60 Fixture Pressures

STATIC PRESSURE COEFFICIENT VS DISTANCE FROM LEADING EDGE

RT-4-001

TEST: OS-61A

M = 0.85

SYB	Φ F	Y	Q
—	DEG	IN.	PSF
0	18	16	756
□	24	16	757

-1.6

-1.4

-1.2

-1.0

-0.8

-0.6

-0.4

-0.2

0

Cp

5

10

15

20

25

30

35

40

x - Distance from leading edge - inches

Figure 6. OS61A Fixture Pressures

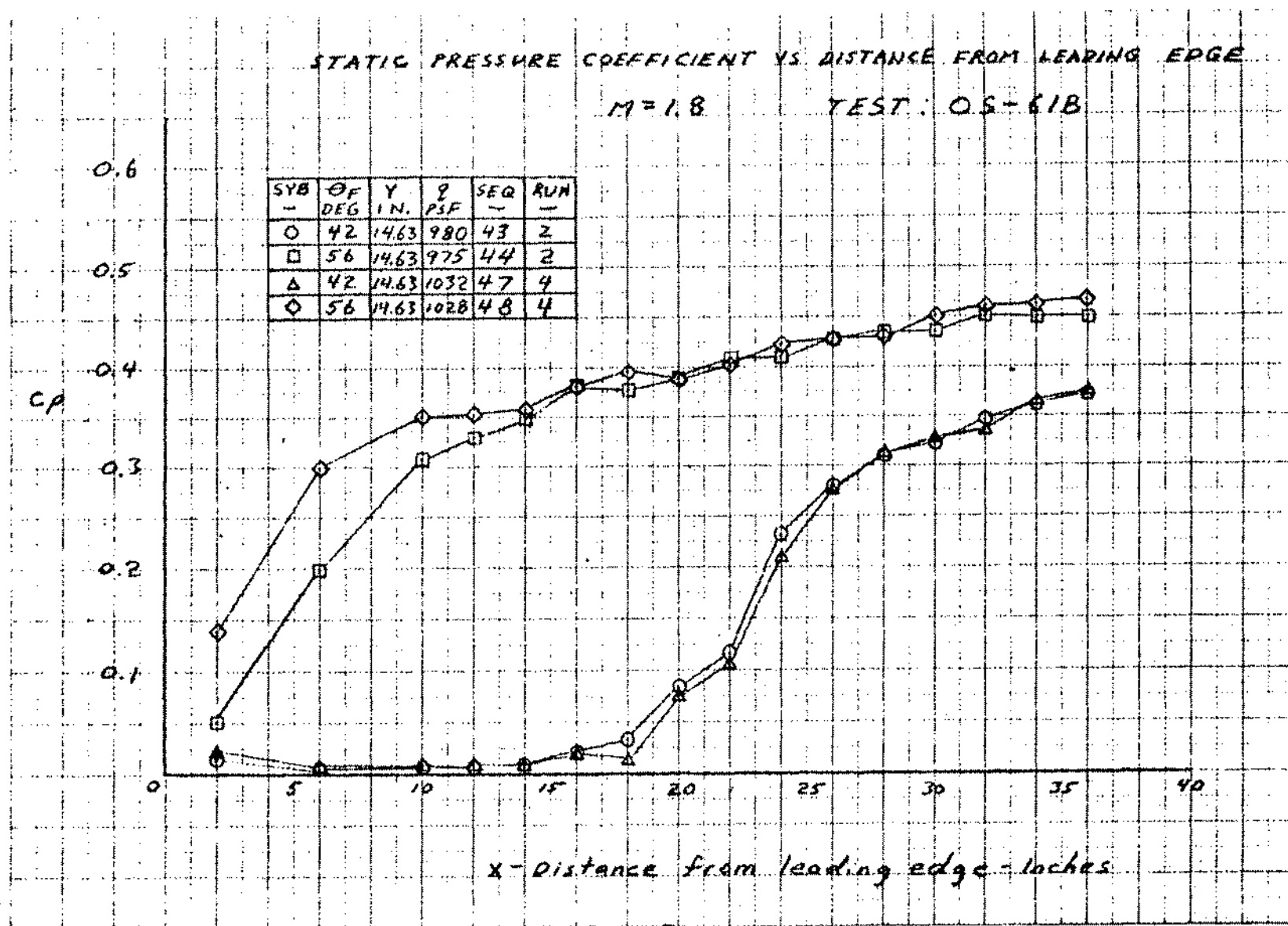


Figure 7. OS61B Fixture Pressures

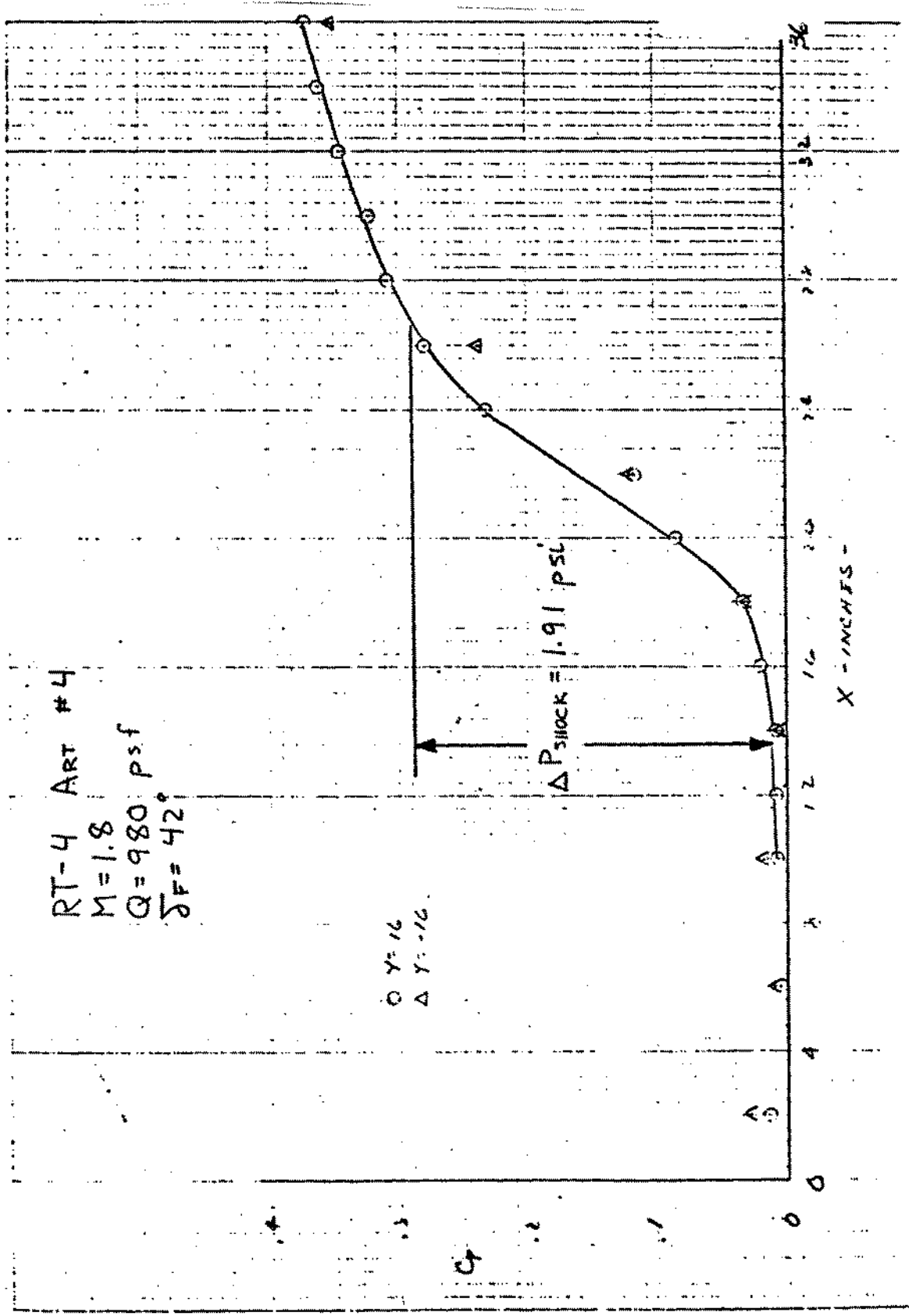


Figure 7. OS61B Fixture Pressures

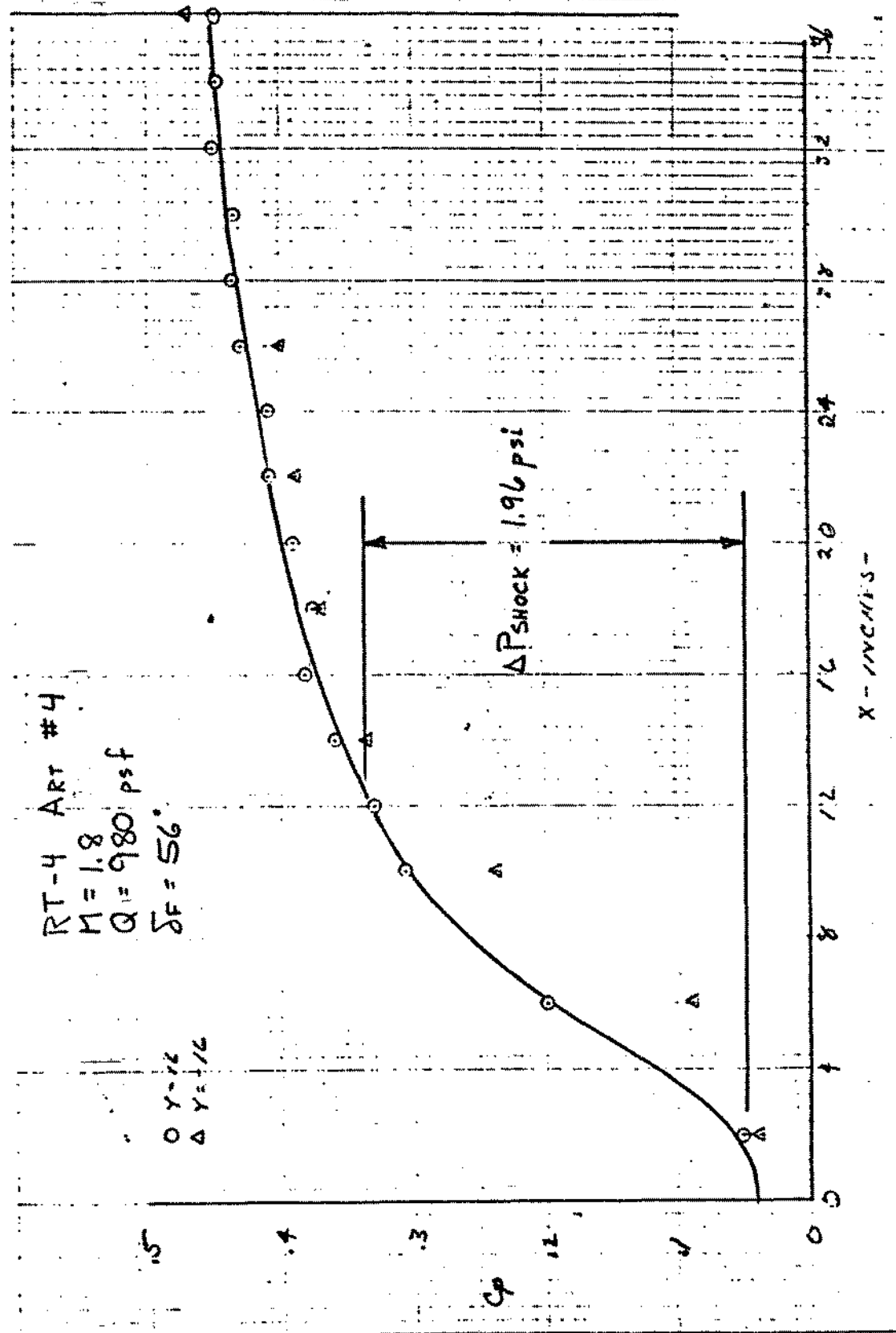


Figure 7. OS61B Fixture Pressures

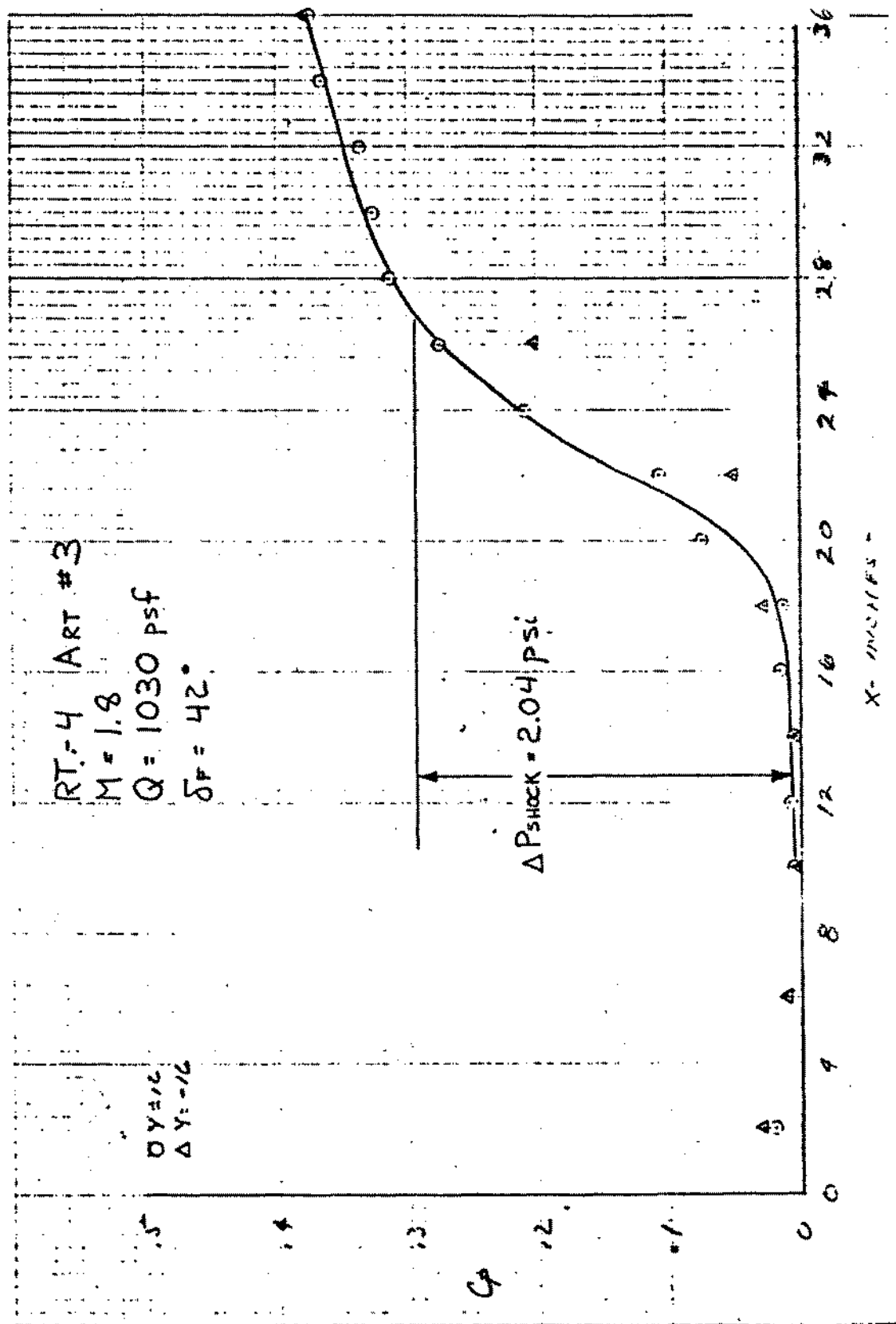


Figure 7. OS61B Fixture Pressures

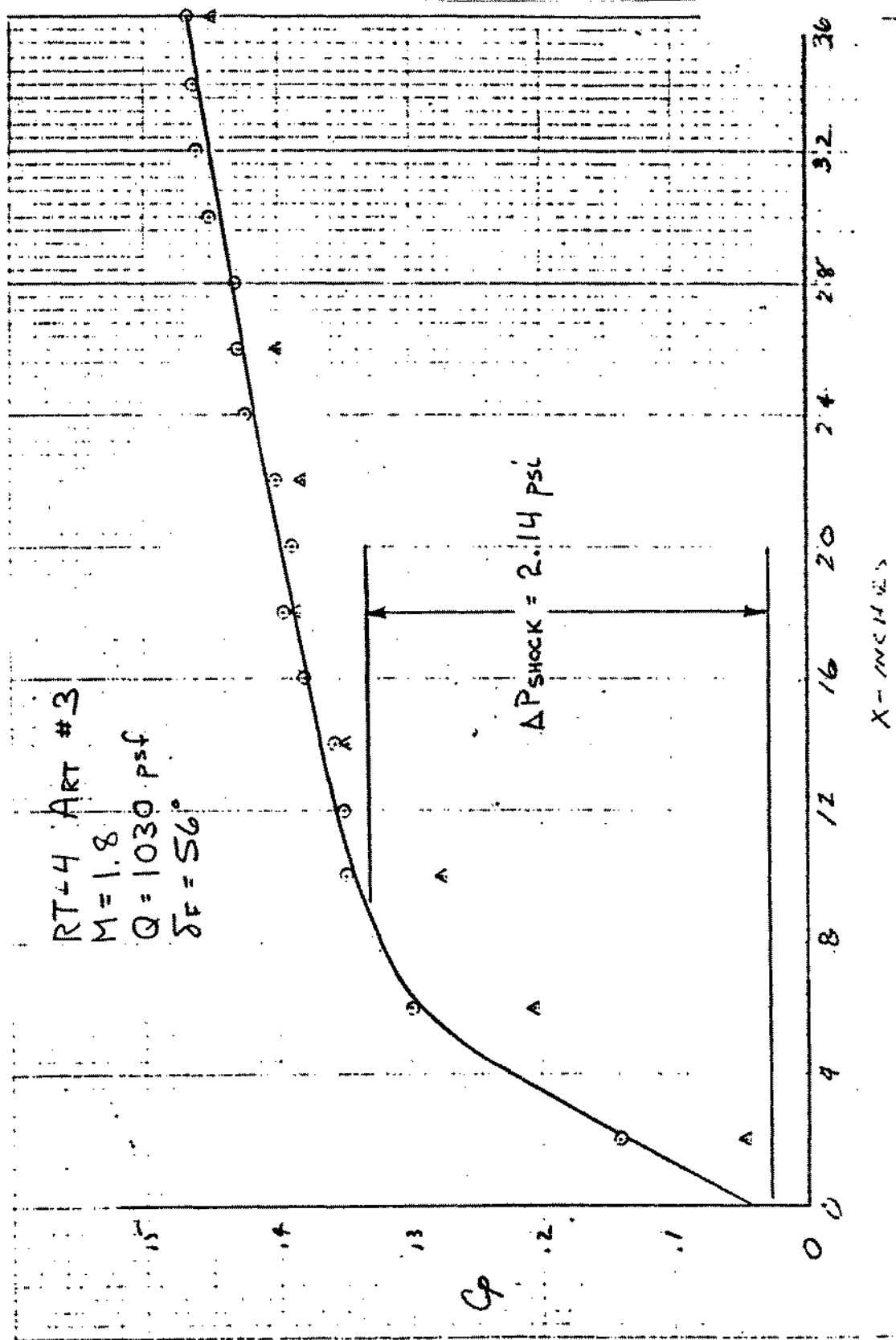


Figure 7. OS61B Fixture Pressures

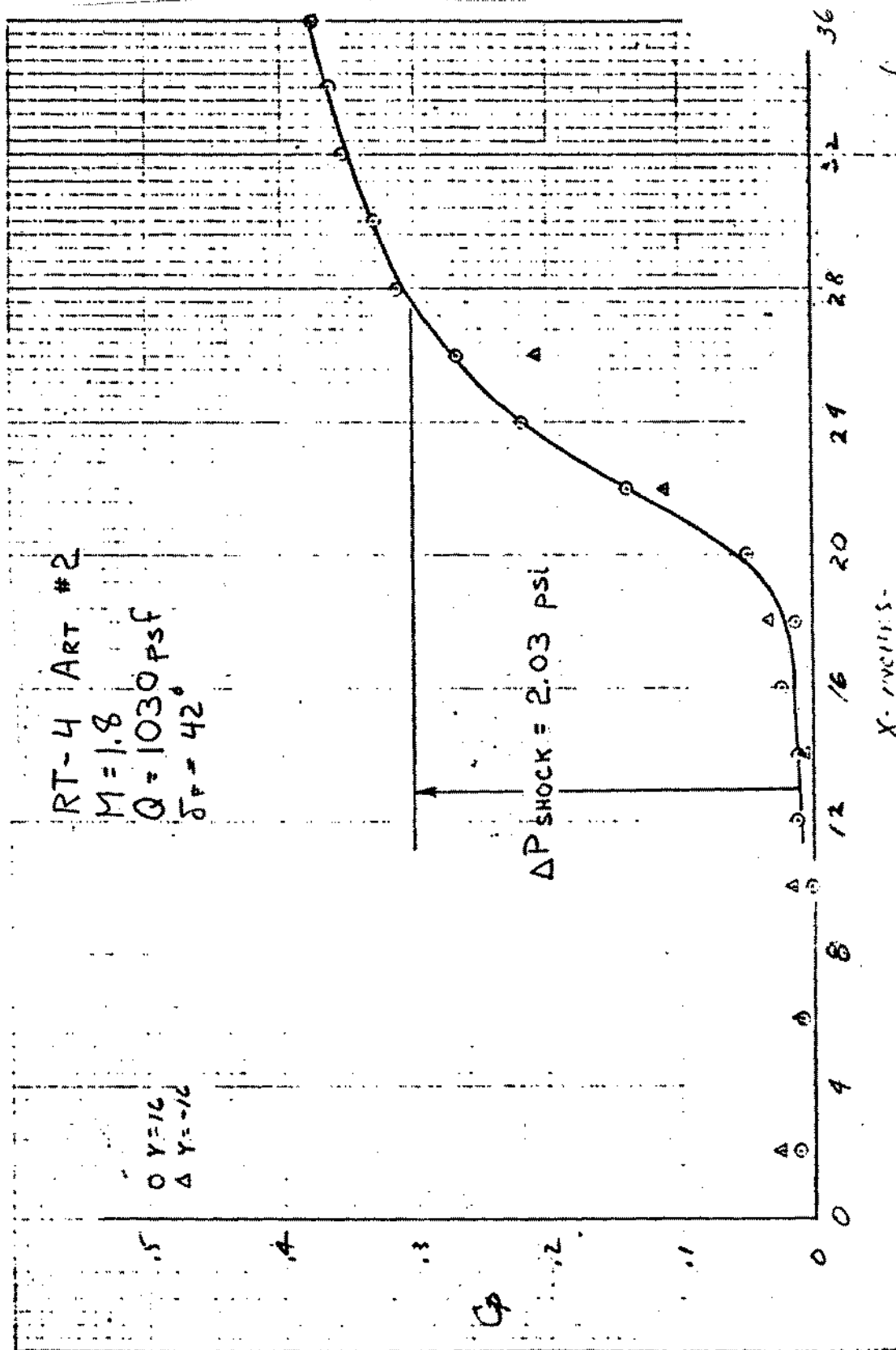


Figure 7. OS61B Fixture Pressures

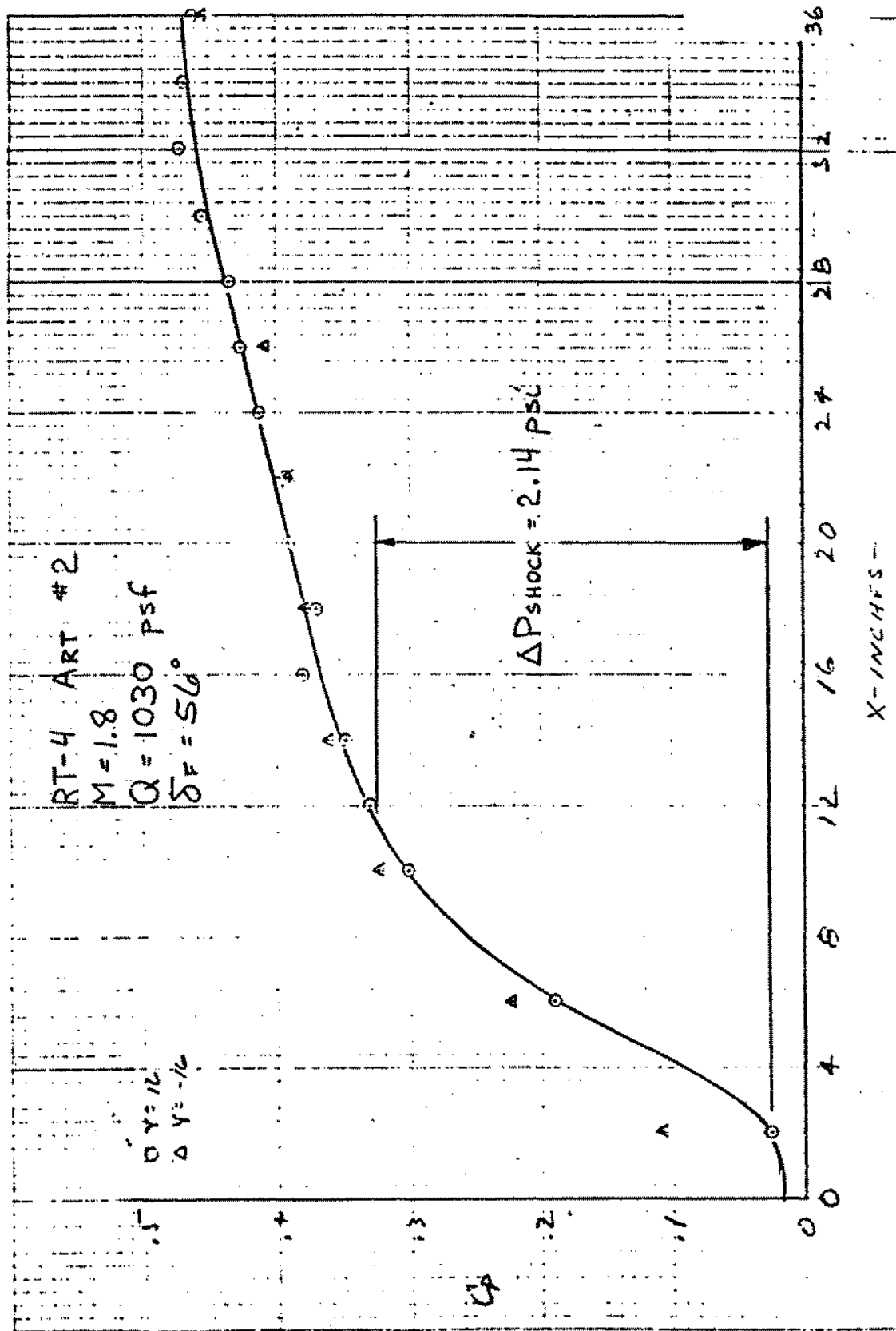
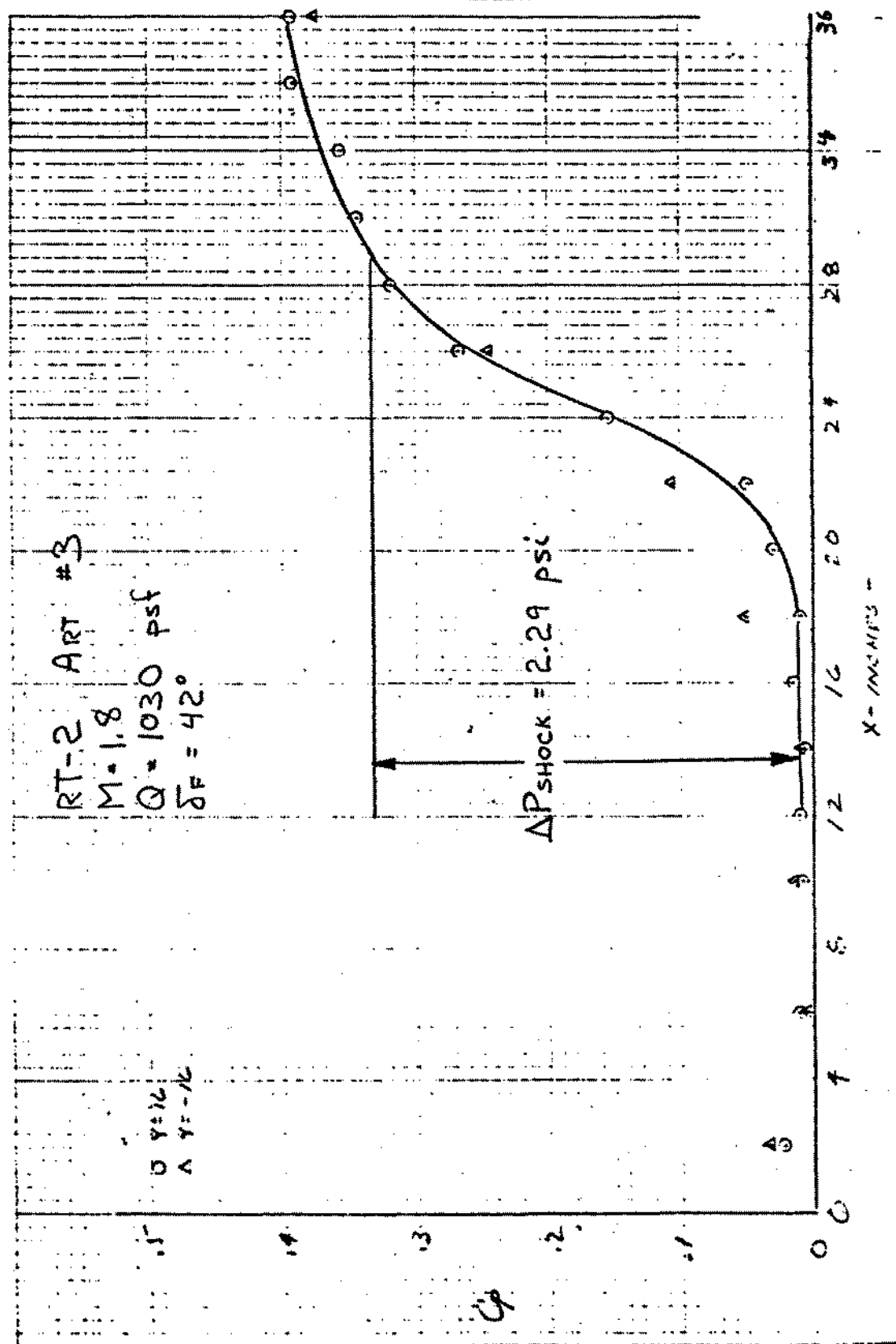


Figure 7. OS61B Fixture Pressures



Fixture 7. OS61B Fixture Pressures

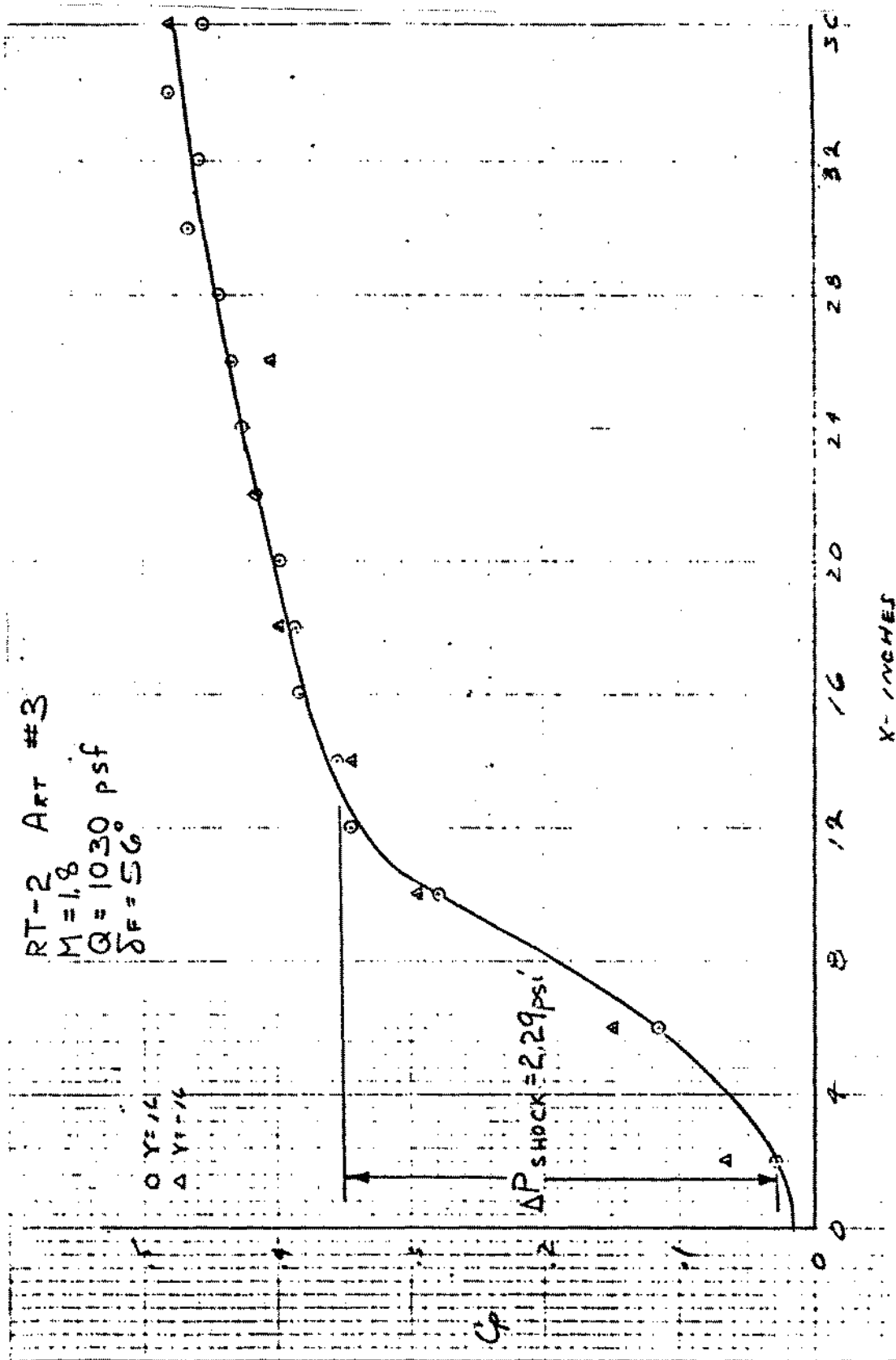


Figure 7. OS61B Fixture Pressures

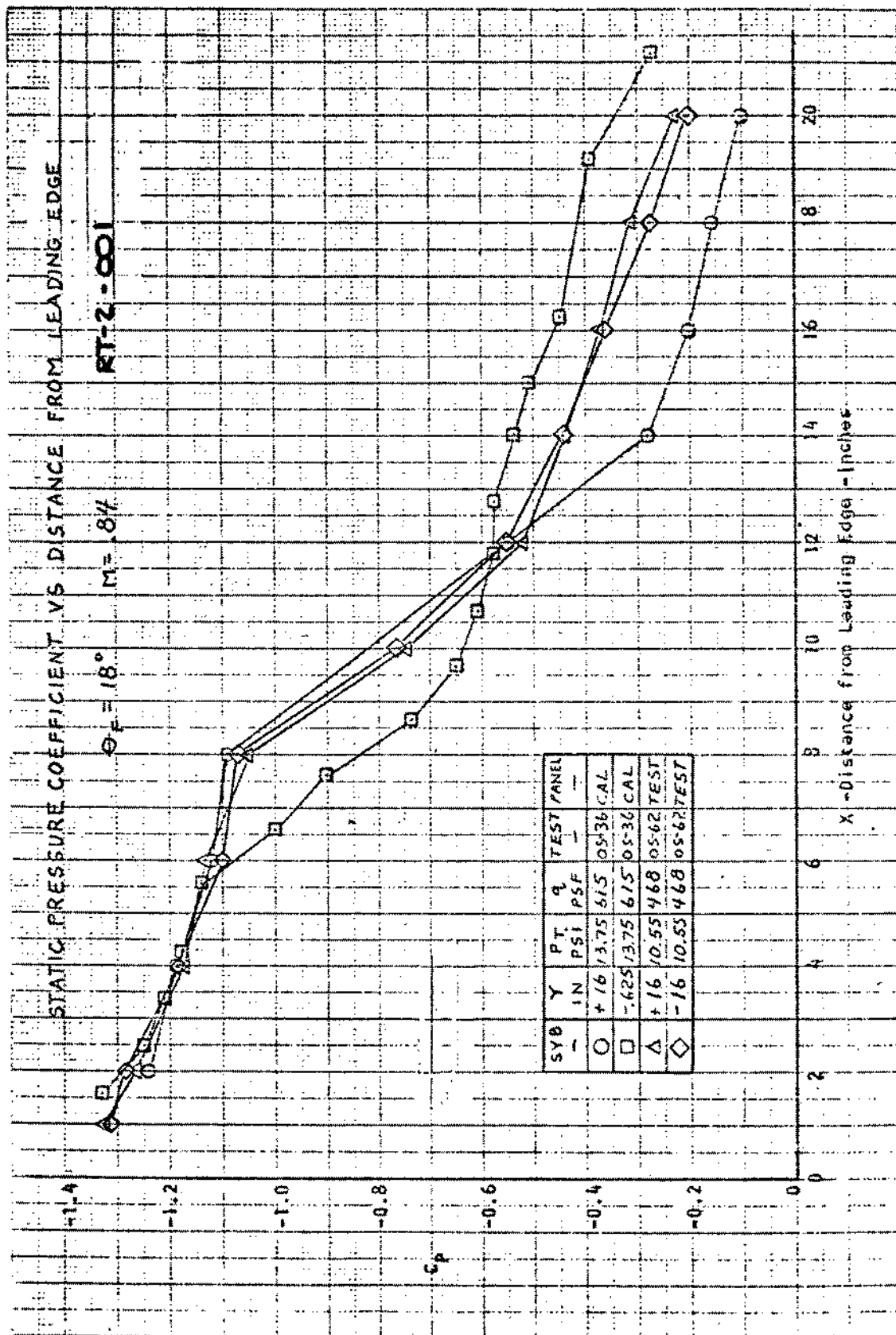


Figure 8. OS62 Fixture Pressures

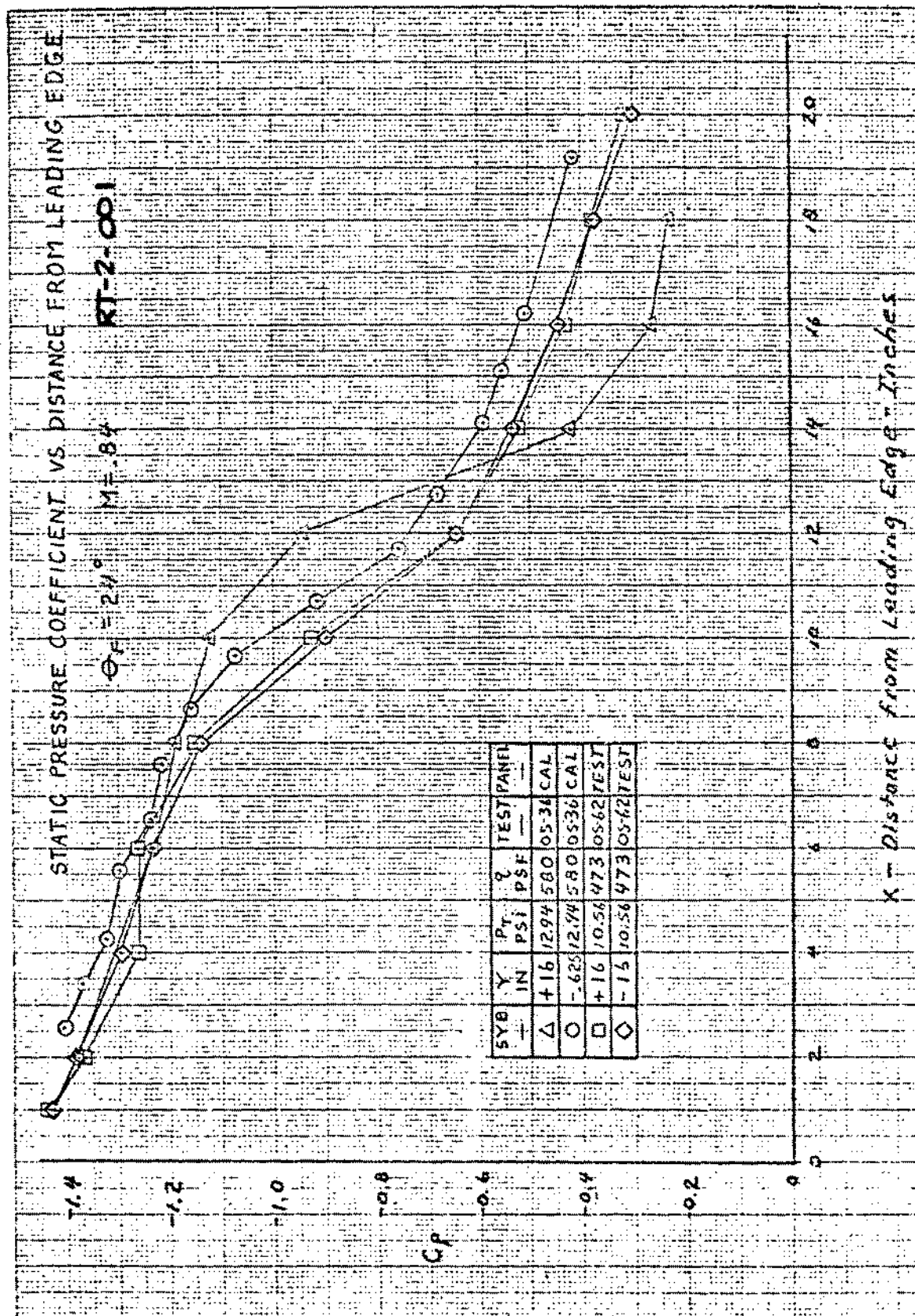


Figure 8. OS62 Fixture Pressures

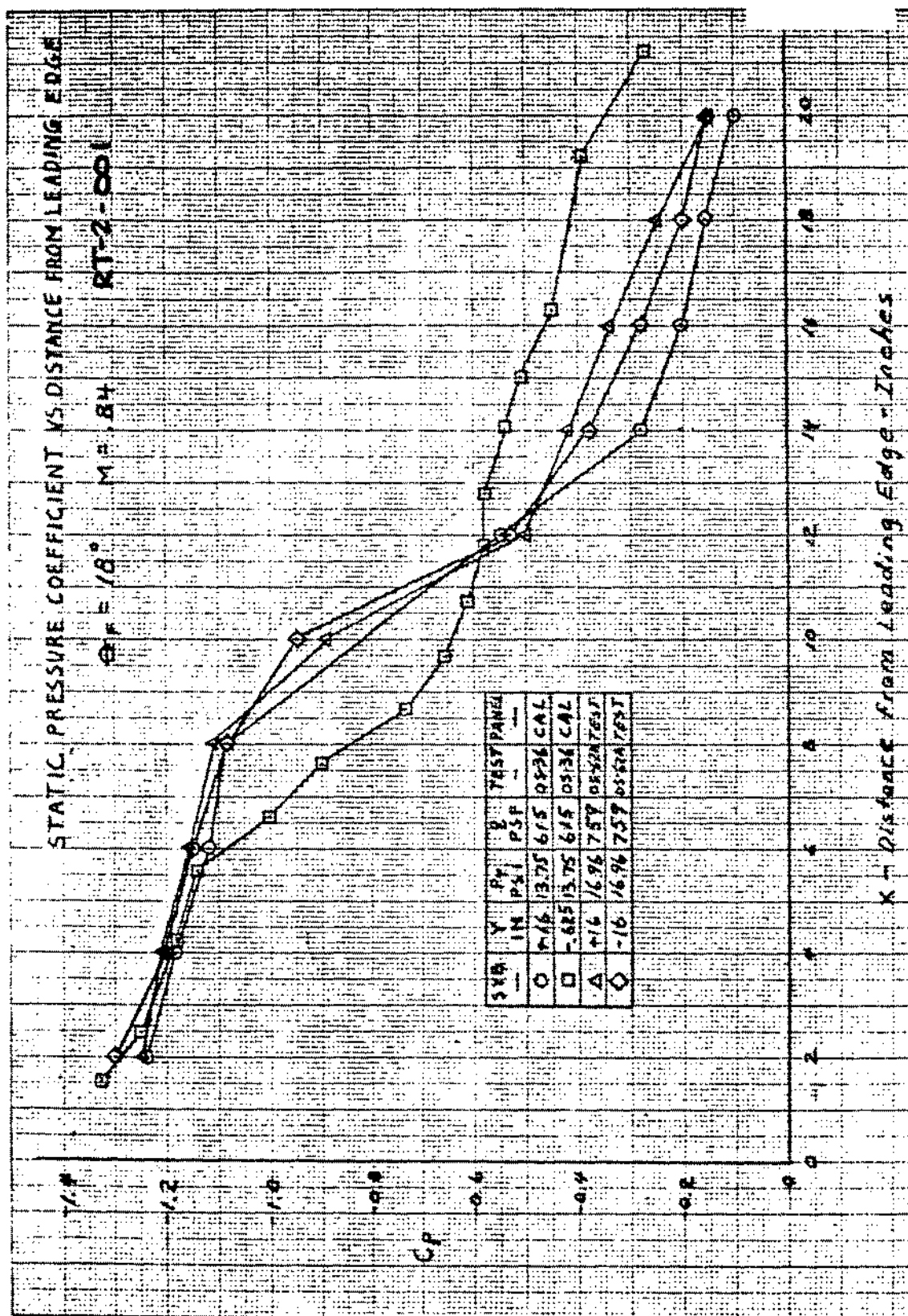


Figure 9. OS62A Fixture Pressures

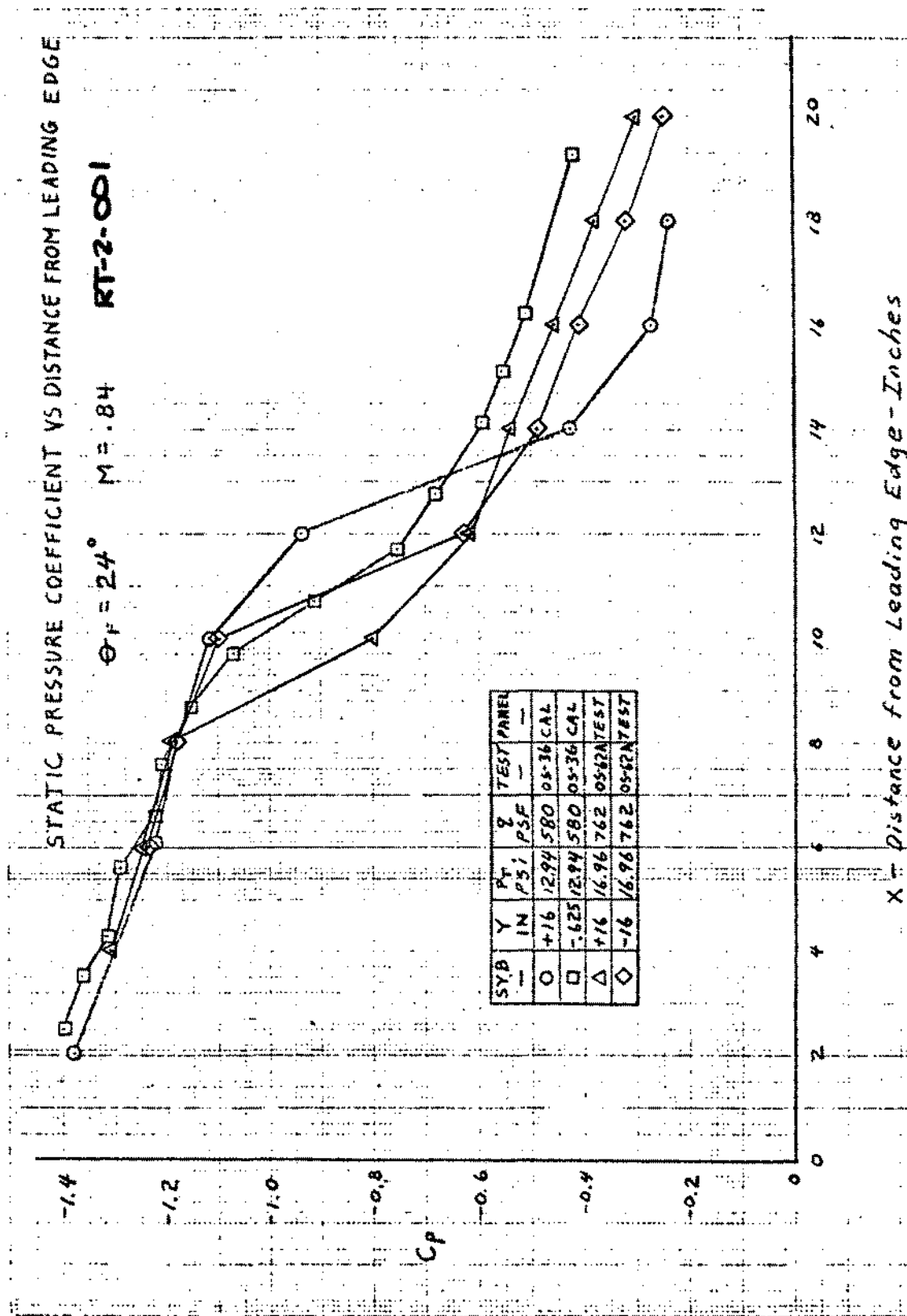


Figure 9. OS62A Fixture Pressures

STATIC PRESSURE COEFFICIENT VS. DISTANCE FROM LEADING EDGE
 $M = 1.8$
 RT-2-004

SYB	Q.P.	Y	8	TEST RUN
—	PSF	IN	—	—
—	PSF	IN	—	—
○	41.0	14.13	660	05.57 3
△	41.8	14.13	1037	05.43 2
□	41.8	14.13	1037	05.63 2

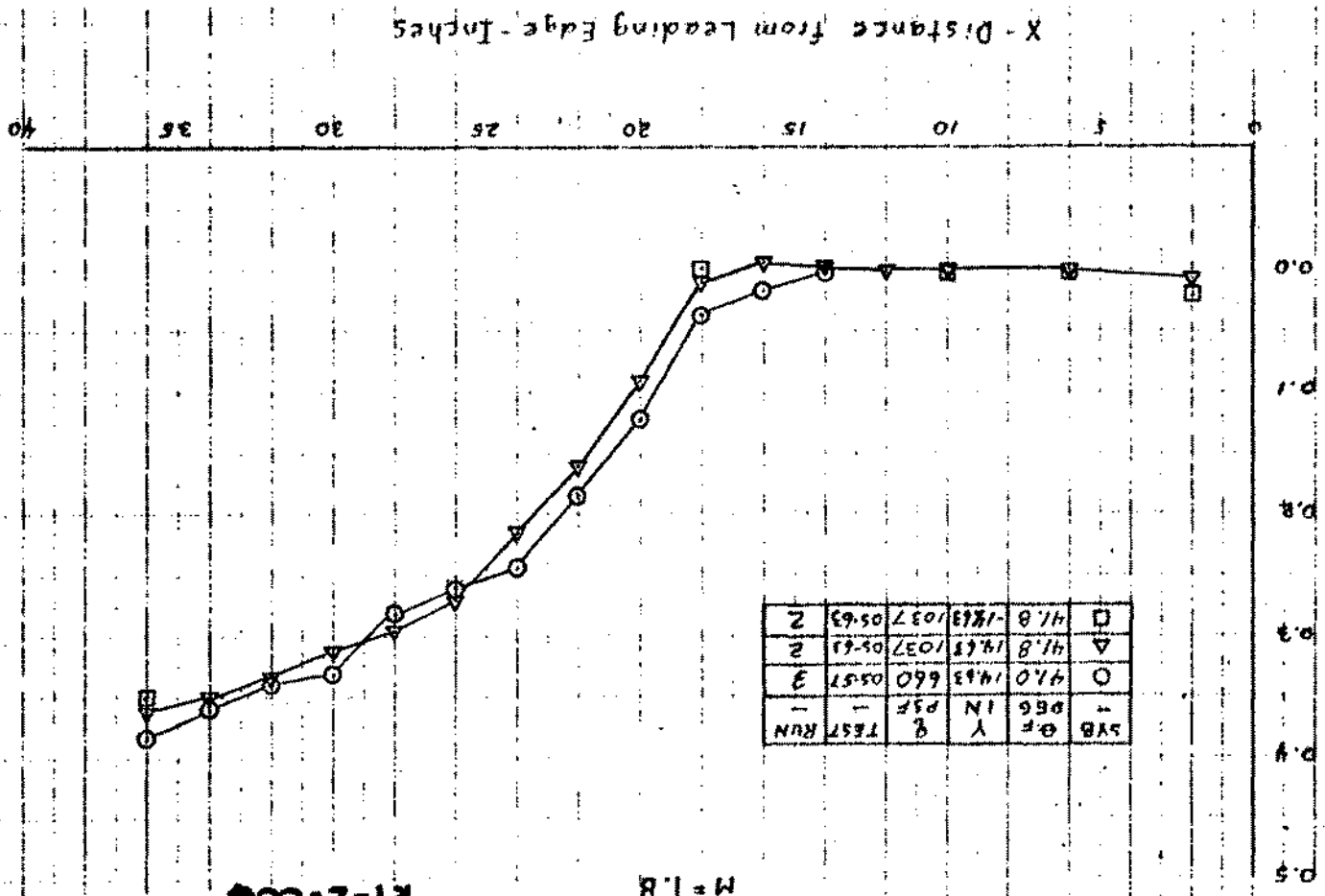


Figure 10. OS63 Fixture Pressures

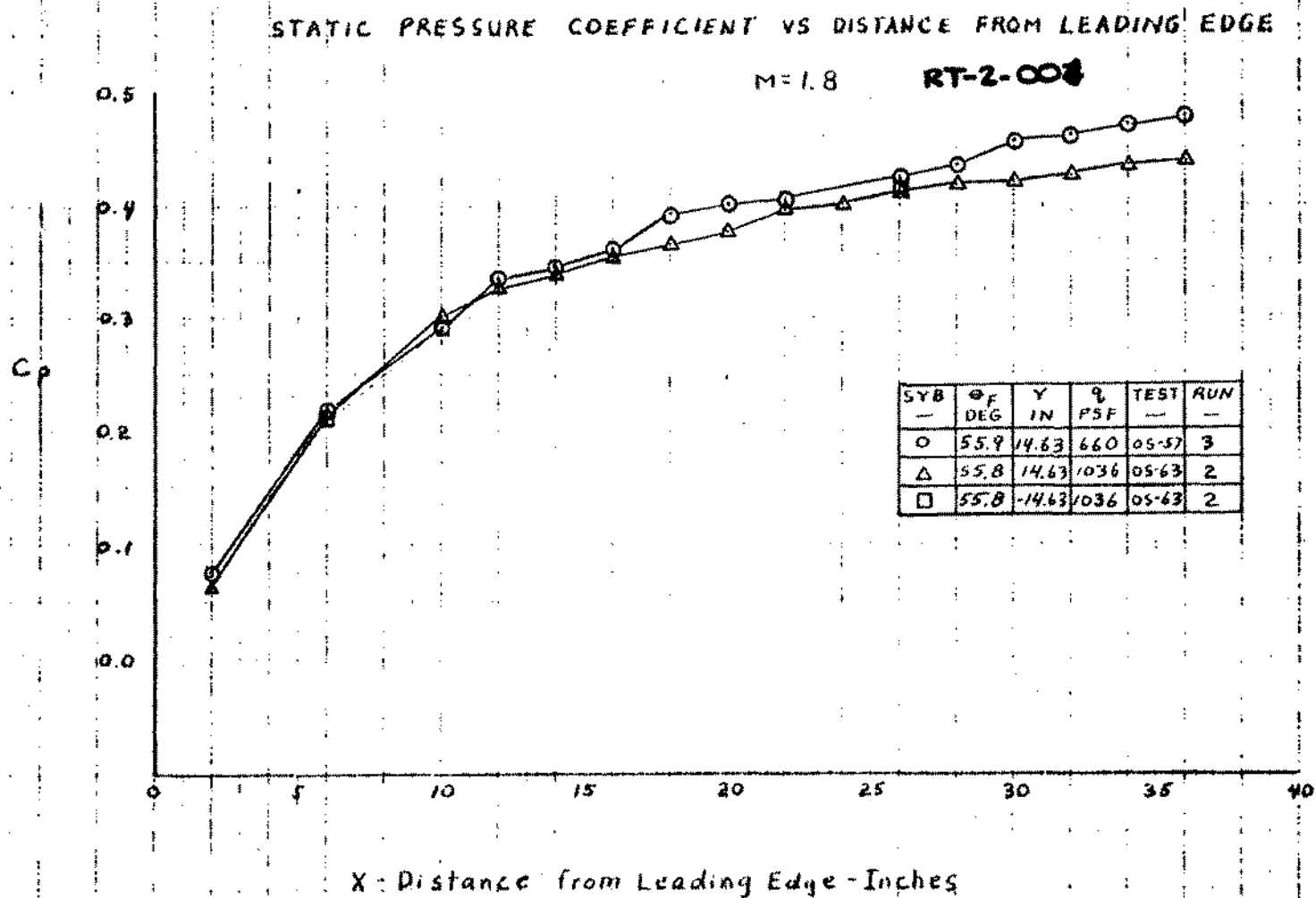
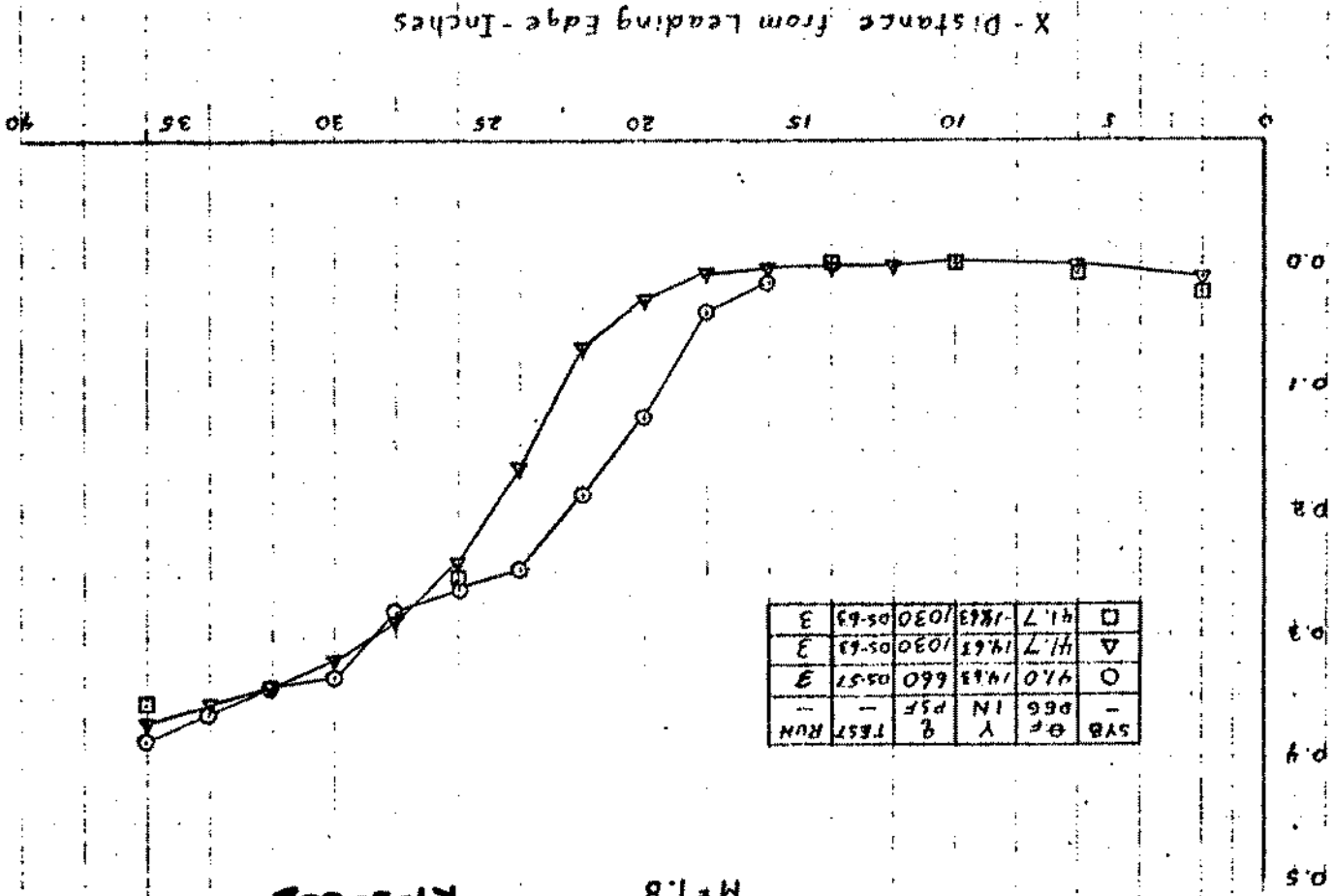


Figure 10. OS63 Fixture Pressures

STATIC PRESSURE COEFFICIENT VS DISTANCE FROM LEADING EDGE
 RT-2-001 M=1.8



X - Distance from Leading Edge - Inches

Figure 10. OS63 Fixture Pressures

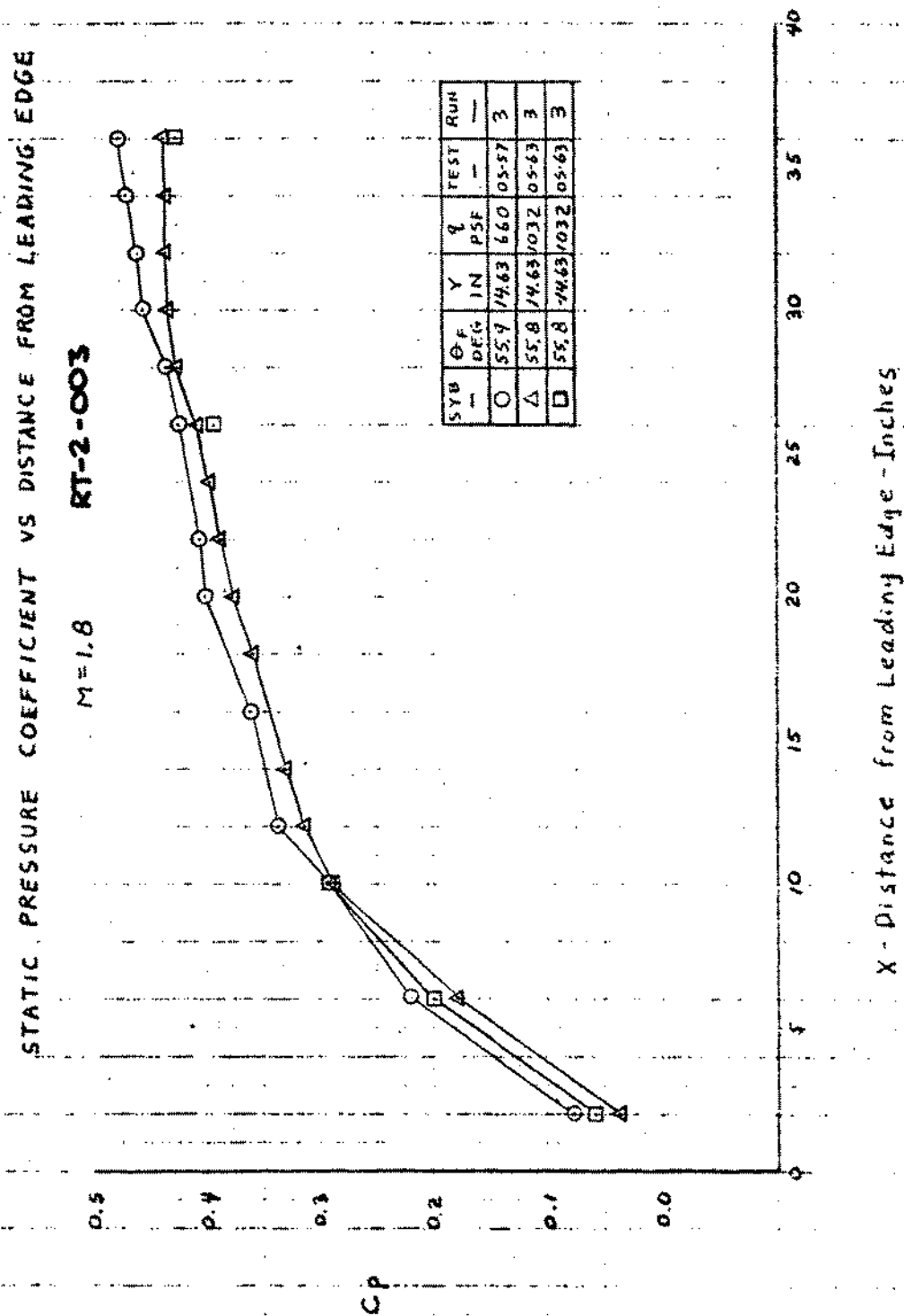
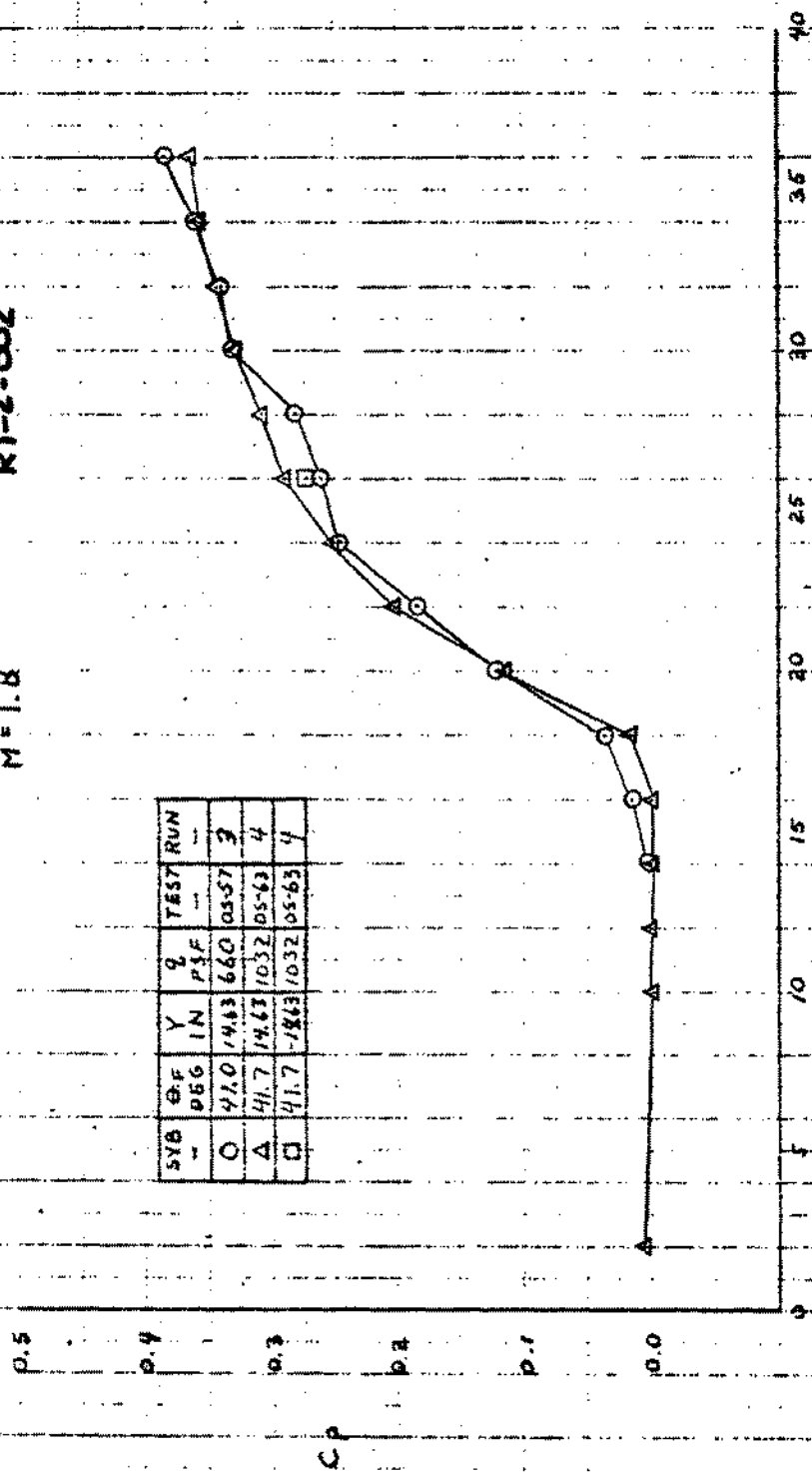


Figure 10. OS63 Fixture Pressures

STATIC PRESSURE COEFFICIENT VS DISTANCE FROM LEADING EDGE

RT-2-002

M=1.8

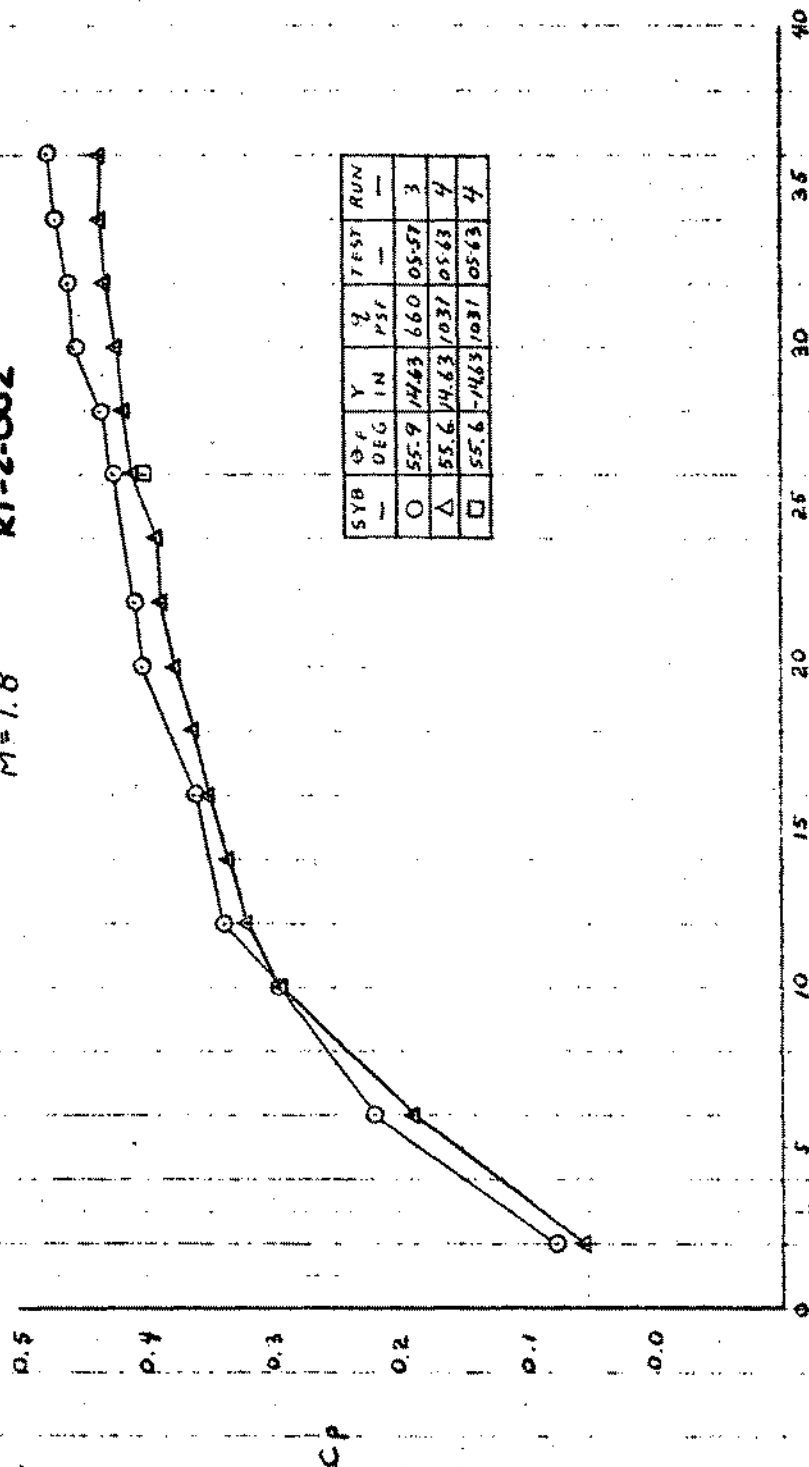


X: Distance from Leading Edge - Inches

Figure 10. OS63 Fixture Pressures

STATIC PRESSURE COEFFICIENT VS DISTANCE FROM LEADING EDGE

$M = 1.8$ RT-2-002



X - Distance from Leading Edge - Inches

Figure 10. OS63 Fixture Pressures

Appendix

Tabulated Source Data

Run 2

RT-3

SEQ	—	1	SEQ	—	2	SEQ	—	3	
M	—	.75	M	—	.80	M	—	.82	
PT	PSI	16.64	PT	PSI	16.64	PT	PSI	16.64	
P	PSI	11.41	P	PSI	11.41	P	PSI	11.41	
Q	PSF	654	Q	PSF	701	Q	PSF	723	
ØF	DEG	18	ØF	DEG	18	ØF	DEG	18	
ORIFICE		CP	ORIFICE		CP	ORIFICE		CP	
1	—	-1.07	1	—	-1.48	1	—	-1.44	
2	—	-.95	2	—	1.42	2	—	-1.39	
3	—	-.83	3	—	-1.25	3	—	-1.34	
4	—	-.68	4	—	-.79	4	—	-1.18	
5	—	-.53	5	—	-.67	5	—	-.77	
6	—	-.40	6	—	-.56	6	—	-.65	
7	—	-.31	7	—	-.48	7	—	-.55	
8	—	-.24	8	—	-.39	8	—	-.47	
9	—	-.20	9	—	-.33	9	—	-.39	
10	—	-.17	10	—	-.28	10	—	-.33	
11	—	-.13	11	—	-.22	11	—	-.25	
12	—	-.11	12	—	-.17	12	—	-.19	
13	—	-.94	13	—	-1.41	13	—	-1.38	
14	—	-.44	14	—	-.59	14	—	-.66	

84

[illegible]

RUN:SEQ TST P TN
2 43 507 1 97

SCANNIVALVES REPORTED IN PSIA

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	979.9	2482.5	432.1	125.7	41.81	2	813	704

X-IN Y=16 Y=-16

2.0	3.103	3.196
6.0	3.037	3.068
10.0	3.047	3.123
12.0	3.058	
14.0	3.057	3.037
16.0	3.137	
18.0	3.223	3.205
20.0	3.572	
22.0	3.790	3.808
24.0	4.579	
26.0	4.897	4.620
28.0	5.100	
30.0	5.190	
32.0	5.355	
34.0	5.454	
36.0	5.527	5.395

RUN:SEQ TST P TN
2 43 507 1 97

SCANNIVALVES REPORTED IN CF

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	979.9	2482.5	432.1	125.7	41.81	2	813	704

X-IN Y=16 Y=-16

2.0	0.015	0.029
6.0	0.005	0.010
10.0	0.007	0.018
12.0	0.008	
14.0	0.008	0.005
16.0	0.020	
18.0	0.033	0.030
20.0	0.084	
22.0	0.116	0.119
24.0	0.232	
26.0	0.279	0.238
28.0	0.308	
30.0	0.322	
32.0	0.346	
34.0	0.361	
36.0	0.371	0.352

RUN:SEQ TST P TN
2 44 507 1 97

SCANNIVALVES REPORTED IN PSIA

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	975.4	2471.2	430.1	121.9	56.07	2	813	705

X-IN Y=16 Y=-16

2.0	3.333	3.245
6.0	4.333	3.591
10.0	5.068	4.597
12.0	5.221	
14.0	5.352	5.263
16.0	5.573	
18.0	5.533	5.494
20.0	5.629	
22.0	5.751	5.616
24.0	5.754	
26.0	5.896	5.698
28.0	5.938	
30.0	5.931	
32.0	6.044	
34.0	6.019	
36.0	6.031	6.184

RUN:SEQ TST P TN
2 44 507 1 97

SCANNIVALVES REPORTED IN CP

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	975.4	2471.2	430.1	121.9	56.07	2	813	705

X-IN Y=16 Y=-16

2.0	0.051	0.038
6.0	0.199	0.089
10.0	0.307	0.238
12.0	0.330	
14.0	0.349	0.336
16.0	0.382	
18.0	0.376	0.370
20.0	0.390	
22.0	0.408	0.388
24.0	0.409	
26.0	0.429	0.400
28.0	0.436	
30.0	0.435	
32.0	0.451	
34.0	0.448	
36.0	0.449	0.472

RUN:SEQ TST P TN
4 47 507 1 97

SCANNIVALVES REPORTED IN PSIA

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1032.1	2614.8	455.1	127.7	41.81	4	813	1229

X-IN Y=16 Y=-16

2.0	3.312	3.373
6.0	3.215	3.246
10.0	3.204	3.182
12.0	3.226	
14.0	3.205	3.185
16.0	3.285	
18.0	3.252	3.363
20.0	3.690	
22.0	3.918	3.522
24.0	4.666	
26.0	5.134	4.600
28.0	5.402	
30.0	5.506	
32.0	5.569	
34.0	5.781	
36.0	5.839	5.875

RUN:SEQ TST P TN
4 47 507 1 97

SCANNIVALVES REPORTED IN CP

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1032.1	2614.8	455.1	127.7	41.81	4	813	1229

X-IN Y=16 Y=-16

2.0	0.021	0.030
6.0	0.008	0.012
10.0	0.006	0.003
12.0	0.009	
14.0	0.006	0.003
16.0	0.017	
18.0	0.013	0.028
20.0	0.074	
22.0	0.106	0.050
24.0	0.210	
26.0	0.275	0.201
28.0	0.313	
30.0	0.327	
32.0	0.336	
34.0	0.366	
36.0	0.374	0.379

RUN:SEQ TST P TN
4 48 507 1 97

SCANNIVALVES REPORTED IN PSIA

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1028.2	2604.9	453.4	128.4	56.07	4	813	1230

X-IN Y=16 Y=-16

2.0	4.149	3.482
6.0	5.285	4.626
10.0	5.652	5.124
12.0	5.662	
14.0	5.708	5.642
16.0	5.859	
18.0	5.980	5.909
20.0	5.929	
22.0	6.009	5.879
24.0	6.174	
26.0	6.202	6.015
28.0	6.234	
30.0	6.369	
32.0	6.435	
34.0	6.454	
36.0	6.480	6.352

RUN:SEQ TST P TN
4 48 507 1 97

SCANNIVALVES REPORTED IN CP

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1028.2	2604.9	453.4	128.4	56.07	4	813	1230

X-IN Y=16 Y=-16

2.0	0.140	0.047
6.0	0.299	0.207
10.0	0.351	0.277
12.0	0.352	
14.0	0.358	0.349
16.0	0.380	
18.0	0.397	0.387
20.0	0.389	
22.0	0.401	0.382
24.0	0.424	
26.0	0.428	0.401
28.0	0.432	
30.0	0.451	
32.0	0.460	
34.0	0.463	
36.0	0.467	0.449

RUN:SEQ TST P TN
6 50 507 1 97

SCANNIVALVES REPORTED IN PSIA

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1026.8	2601.3	452.7	123.6	41.97	1	814	159

X-IN Y=16 Y=-16

2.0	3.228	3.329
6.0	3.200	3.221
10.0	3.151	3.258
12.0	3.231	
14.0	3.220	3.190
16.0	3.310	
18.0	3.238	3.379
20.0	3.488	
22.0	4.152	3.942
24.0	4.703	
26.0	5.064	4.628
28.0	5.375	
30.0	5.510	
32.0	5.679	
34.0	5.748	
36.0	5.830	5.830

RUN:SEQ TST P TN
6 50 507 1 97

SCANNIVALVES REPORTED IN CP

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1026.8	2601.3	452.7	123.6	41.97	1	814	159

X-IN Y=16 Y=-16

2.0	0.012	0.026
6.0	0.008	0.011
10.0	0.001	0.016
12.0	0.012	
14.0	0.011	0.007
16.0	0.023	
18.0	0.013	0.033
20.0	0.048	
22.0	0.141	0.112
24.0	0.219	
26.0	0.269	0.208
28.0	0.313	
30.0	0.332	
32.0	0.355	
34.0	0.365	
36.0	0.377	0.377

RUN:SEQ TST P TN
6 51 507 1 97

SCANNIVALVES REPORTED IN PSIA

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1026.0	2599.2	452.4	124.0	56.23	1	814	200

X-IN Y=16 Y=-16

2.0	3.324	3.919
6.0	4.493	4.729
10.0	5.296	5.457
12.0	5.501	
14.0	5.623	5.722
16.0	5.857	
18.0	5.776	5.841
20.0	5.930	
22.0	5.940	5.916
24.0	6.084	
26.0	6.187	6.049
28.0	6.242	
30.0	6.394	
32.0	6.504	
34.0	6.475	
36.0	6.440	6.381

RUN:SEQ TST P TN
6 51 507 1 97

SCANNIVALVES REPORTED IN CP

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1026.0	2599.2	452.4	124.0	56.23	1	814	200

X-IN Y=16 Y=-16

2.0	0.026	0.109
6.0	0.190	0.223
10.0	0.302	0.325
12.0	0.331	
14.0	0.348	0.362
16.0	0.381	
18.0	0.370	0.379
20.0	0.391	
22.0	0.393	0.389
24.0	0.413	
26.0	0.427	0.408
28.0	0.435	
30.0	0.456	
32.0	0.472	
34.0	0.468	
36.0	0.463	0.455

RUN:SEQ TST P TN
8 54 507 1 97

SCANNIVALVES REPORTED IN PSIA

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1031.8	2614.1	455.0	119.9	41.97	3	814	525

X-IN Y=16 Y=-16

2.0	3.323	3.403
6.0	3.235	3.196
10.0	3.215	3.263
12.0	3.236	
14.0	3.205	3.215
16.0	3.275	
18.0	3.223	3.522
20.0	3.364	
22.0	3.502	3.917
24.0	4.262	
26.0	5.076	4.918
28.0	5.439	
30.0	5.617	
32.0	5.720	
34.0	5.961	
36.0	5.969	5.854

RUN:SEQ TST P TN
8 54 507 1 97

SCANNIVALVES REPORTED IN CP

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1031.8	2614.1	455.0	119.9	41.97	3	814	525

X-IN Y=16 Y=-16

2.0	0.023	0.034
6.0	0.011	0.005
10.0	0.008	0.014
12.0	0.011	
14.0	0.006	0.008
16.0	0.016	
18.0	0.009	0.051
20.0	0.028	
22.0	0.048	0.106
24.0	0.154	
26.0	0.267	0.245
28.0	0.318	
30.0	0.343	
32.0	0.357	
34.0	0.391	
36.0	0.392	0.376

RUN:SEQ TST P IN
8 55 507 1 97

SCANNIVALVES REPORTED IN PSIA

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1033.5	2618.3	455.7	121.6	55.90	3	814	526

X-IN Y=16 Y=-16

2.0	3.363	3.641
6.0	3.986	4.234
10.0	5.168	5.275
12.0	5.650	
14.0	5.720	5.637
16.0	5.914	
18.0	5.933	6.020
20.0	6.023	
22.0	6.139	6.153
24.0	6.212	
26.0	6.264	6.056
28.0	6.339	
30.0	6.500	
32.0	6.448	
34.0	6.605	
36.0	6.419	6.596

RUN:SEQ TST P IN
8 55 507 1 97

SCANNIVALVES REPORTED IN CP

MACH	Q	PT	P	TTF	FLAP	CONF	DATE	TIME
1.800	1033.5	2618.3	455.7	121.6	55.90	3	814	526

X-IN Y=16 Y=-16

2.0	0.028	0.066
6.0	0.115	0.149
10.0	0.279	0.294
12.0	0.346	
14.0	0.356	0.344
16.0	0.383	
18.0	0.386	0.398
20.0	0.398	
22.0	0.414	0.416
24.0	0.425	
26.0	0.432	0.403
28.0	0.442	
30.0	0.465	
32.0	0.457	
34.0	0.479	
36.0	0.453	0.478

SEQ	—	1			SEQ	—	2
M	—	.83			M	—	.84
P _T	PSI	10.55			P _T	PSI	10.56
P	PSI	6.70			P	PSI	6.66
Q	PSF	468			Q	PSF	473
Θ _F	DEG	18			Θ _F	DEG	24
ORIFICE					ORIFICE		
C _p 101	—	-1.37			C _p 101	—	-1.47
102		-1.33			102		-1.43
103		-1.27			103		-1.37
104		-1.18			104		-1.26
105		-1.13			105		-1.26
106		-1.05			106		-1.15
107		-0.74			107		-0.93
108		-0.52			108		-0.64
109		-0.44			109		-0.52
110		-0.38			110		-0.44
111		-0.31			111		-0.38
112		-0.23			112		-0.32
113		-0.11			113		-0.20
114		-0.04			114		-0.06
201		-1.36			201		-1.48
202		-1.32			202		-1.42
203		-1.29			203		-1.39
204		-1.19			204		-1.30
205		-1.10			205		-1.24
206		-1.08			206		-1.13
207		-0.77			207		-0.90
208		-0.55			208		-0.64
209		-0.44			209		-0.53
210		-0.36			210		-0.45
211		-0.28			211		-0.38
212		-0.20			212		-0.30
213		-0.09			213		-0.20
214	↓	-0.03			214	↓	-0.05

RT-2 No. 1

SEQ — N.A.
M — .84
PT PSI 16.96
P PSI 10.70
Q PSF 759
 Θ_F DEG 18

SEQ — N.A.
M — .84
PT PSI 16.96
P PSI 10.66
Q PSF 762
 Θ_F DEG 24

ORIFICE

Cp 101

102 — -1.30
103 — -1.25
104 — -1.21
105 — -1.16
106 — -1.11
107 — -0.89
108 — -0.50
109 — -0.42
110 — -0.34
111 — -0.25
112 — -0.15
113 — -0.03
114 — -0.02
201 — -1.35
202 — —
203 — -1.29
204 — -1.20
205 — -1.15
206 — -1.08
207 — -0.95
208 — -0.53
209 — -0.38
210 — -0.28
211 — -0.20
212 — -0.15
213 — -0.67
214 — -0.01

ORIFICE

Cp 101

102 — —
103 — —
104 — -1.31
105 — -1.25
106 — -1.19
107 — -0.80
108 — -0.62
109 — -0.54
110 — -0.46
111 — -0.38
112 — -0.30
113 — -0.14
114 — -0.03
201 — —
202 — —
203 — —
204 — —
205 — -1.24
206 — -1.18
207 — -1.10
208 — -0.63
209 — -0.49
210 — -0.41
211 — -0.32
212 — -0.25
213 — -0.14
214 — -0.03

RT-2 No. 2

SEQ	—	3
M	—	1.8
PT	PSI	18.16
P	PSI	3.16
Q	PSF	1032
ΦF	DEG	41.7

SEQ	—	4
M	—	1.8
PT	PSI	18.14
P	PSI	3.16
Q	PSF	1031
ΦF	DEG	55.6

ORIFICE	
CP 101	—
103	—
105	—
107	—
110	—
113	—
115	0.273
116	—
201	0.011
203	0.001
205	-0.007
207	0.003
209	0.002
211	0.005
213	0.035
215	0.131
217	0.206
219	0.252
221	0.290
222	0.316
224	0.328
225	0.343
227	0.357
228	0.364

ORIFICE	
CP 101	—
103	—
105	—
107	—
110	—
113	—
115	0.400
116	—
201	0.053
203	0.185
205	0.292
207	0.320
209	0.335
211	0.350
213	0.363
215	0.377
217	0.386
219	0.393
221	0.410
222	0.417
224	0.422
225	0.430
227	0.434
228	0.435

RT-2 No. 3

SEQ — 2
 M — 1.8
 PT PSI 18.13
 P PSI 3.15
 Q PSF 1030
 Θ F DEG 41.7

SEQ — 3
 M — 1.8
 PT PSI 18.16
 P PSI 3.16
 Q PSF 1032
 Θ F DEG 55.8

ORIFICE

CP 101	—	0.023
103		0.005
105		-0.001
107		0.001
110		—
113		—
115		0.253
116		0.355
201		0.011
203		0.001
205		-0.003
207		0.004
209		0.006
211		0.003
213		0.006
215		0.029
217		0.068
219		0.165
221		0.242
222		0.288
224		0.318
225		0.341
227		0.355
228	Y	0.368

ORIFICE

CP 101	—	0.059
103		0.200
105		0.294
107		—
110		—
113		—
115		0.392
116		0.425
201		0.037
203		0.178
205		0.288
207		0.313
209		0.332
211		0.350
213		0.361
215		0.376
217		0.386
219		0.397
221		0.411
222		0.423
224		0.431
225		0.435
227		0.436
228	Y	0.436

RT-2 No. 4

SEQ	—	2
M	—	1.8
PT	PSI	18.13
P	PSI	3.23
Q	PSF	1037
ΦF	DEG	41.8

SEQ	—	3
M	—	1.8
PT	PSI	18.11
P	PSI	3.22
Q	PSF	1036
ΦF	DEG	55.8

ORIFICE

CP 101	—	0.021
103		0.002
105		0.004
107		-0.002
110		-0.001
113		0.003
115		0.261
116		0.350
201		0.009
203		-0.002
205		-0.001
207		0.003
209		-0.001
211		-0.005
213		—
215		0.081
217		0.160
219		0.217
221		0.268
222		0.297
224		0.314
225		0.333
227		0.350
228	↓	0.363

ORIFICE

CP 101	—	0.077
103		0.212
105		0.239
107		—
110		—
113		—
115		0.418
116		0.444
201		0.061
203		0.213
205		0.301
207		0.325
209		0.337
211		0.353
213		0.366
215		0.377
217		0.383
219		0.401
221		0.410
222		0.419
224		0.420
225		0.426
227		0.435
228	↓	0.437

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